ABSTRACTS OF NORTH AMERICAN GEOLOGY

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ABSTRACTS OF NORTH AMERICAN GEOLOGY

INTRODUCTION

Abstracts of North American Geology contains abstracts of technical papers and books and also citations of maps on the geology of North America including Greenland, the West Indies, as well as the State of Hawaii, Guam, and other island possessions of the United States. Articles of a general nature by North American authors are cited even though published in foreign journals, but those by foreign authors are included only if they appear in North American journals. Abstracts are prepared only of material that is believed to be generally available. Ordinarily abstracts are not published of material with limited circulations (such as dissertations, open-file reports, or memorandums) or of other papers presented orally at meetings.

The Abstracts will be an additional reference tool but will not replace the Bibliography of North American Geology, which has been published by the Geological Survey since 1887. Twelve monthly issues of Abstracts of North American Geology will be published each year. The Bibliography will include citations and subject index for a calendar year.

Abstracts of North American Geology and the Bibliography are being prepared by use of computer techniques. Each abstract along with its indexing is placed on magnetic tape and entered into a permanent data bank. The material prepared each month will be published in the form of the present issue. The abstracts are arranged alphabetically according to senior author. A subject index follows the abstracts and is designed for rapid reference to any subject desired. Bibliographies can subsequently be retrieved according to the terms used in the index.

The abstracts in this issue were prepared by W. R. Averett, Fred Barker, R. A. Cadigan, Georgianna D. Conant, Eleanor J. Crosby, W. C. Culbertson, Claire B. Davidson, R. E. Grant, Andrew Griscom, J. J. Hemley, B. H. Kent, Virginia M. Jussen, B. F. Leonard, Elisabeth S. Loud, S. H. Mamay, E. K. Maughan, E. D. McKee, Mildred C. Mead, A. T. Miesch, Virginia S. Neuschel, D. W. Rankin A. E. Roberts, E. T. Ruppel, V. E. Swanson, J. G. Vedder, Dorothy B. Vitaliano, H. C. Wagner, W. S. White, F. C. Whitmore, Jr., R. E. Wilcox, and R. G. Yates.

ABSTRACTS

Ahmed, F. R. *See* Swallow, A. G. 7235

Algert, James H. *See* Nordin, Carl F., Jr. 7555

7269 **Allen, J. R. L.** On bed forms and paleocurrents: Sedimentology, v. 6, no. 3, p. 153–190, illus., tables, 1966.

Bedforms arise by interaction between a fluid flow and the sediment transported over or close to the bed. Their geometry is two- or three-dimensional, according to the internal sedimentary structures they generate and the flow-vector fields to which they are adjusted. Many shallow-water flow systems observable today are characterized by flow-vector fields of unequal rank, and hence are hierarchically structured. A single type of bedform or internal structure from an hierarchically structured flow system cannot specify that system fully with regard to either its directional or flow-dynamic characteristics. Therefore, an approach to paleocurrent analysis that is more flexible and comprehensive than previously attempted may be desirable.—G.D.C.

7678 **Allen, J. R. L.** Flow visualization using plaster of paris: Jour. Sed. Petrology, v. 36, no. 3, p. 806–811, illus., 1966.

The mode of origin of many current-formed sedimentary structures may be visualized through the use of models composed of plaster of paris immersed in water streams. Flow patterns are recorded as bubbles of entrapped gas or pits on the surface; they reveal factors in the development of current crescents, ripple marks and other structures.—E.D.M.

Allen, Jack A. *See* Haynes, C. Vance, Jr. 7534

7558 **Am. Soc. Civil Engineers.** (Task Comm.) Sediment transportation mechanics—Wind erosion and transportation—Closure [to discussion of paper 4261, 1965]: Am. Soc. Civil Engineers Proc., v. 92, Jour. Hydraulics Div., no. HY 5, p. 195–197, 1966.

In condensing material on wind erosion for the manual, considerable detail was omitted including discussion of the effects of moisture content of soil on wind erosion, believed by Raudkivi and Chepil to be important. Corrections are given here to equations expressing the rate of movement of moistened erodible particles on "smooth" soil surfaces. In bare soils containing a mixture of erodible and nonerodible fractions, the quantity of soil removed by wind is limited by the height and number of nonerodible fractions that become exposed on the surface. Because formation of dunes and ripples is not a prominent problem on arable lands, the committee did not treat this in detail.—G.D.C.

7545 **Anderson, Charles A.** Areal geology of the Southwest, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 3–16, illus., table, 1966.

The paper is focused on the features that may be germane to the location and distribution of porphyry copper deposits, which limits it largely to Arizona and southwestern New Mexico. The physiography of the Colorado Plateau–Basin and

Range area is reviewed, and the Precambrian geology discussed in detail. Paleozoic and Mesozoic sedimentation was followed by Cretaceous and early Tertiary deformation. Mesozoic and younger plutonic rocks are described. The Plateau and Basin and Range province both came into existence during the Cenozoic, and their history is reviewed. The possibility of a relationship between regional potassium–sodium ratios and the distribution of copper is discussed briefly.—E.S.L.

Anderson, James A. *See* Bauer, Herman L., Jr. 7543

Andreasen, G. E. *See* Lindsley, D. H. 7347

Archbold, Michael F. *See* Holland, F. D., Jr. 7467

7279 **Armstrong, Richard Lee.** K–Ar dating of plutonic and volcanic rocks in orogenic belts, *in* Potassium argon dating: New York, Springer-Verlag, p. 117–133, illus., table, 1966.

Several conditions necessary for age determination are given, and materials most suitable (unweathered, rich in hornblende and mica, and low in excess argon) for dating plutonic rocks are described. In volcanic rocks, high-temperature feldspars are important, and unaltered glass provides a useful check on coexisting minerals. In order to discuss interpretation of dates in an orogen, a simplified model is introduced reflecting knowledge of several real orogens; the stages in its history are described. The conclusion is reached that metamorphism has no exact age; it spans a period of time. The term metamorphic veil is used for a conceptual surface in space-time that synthesizes dating results on metamorphic rocks. We do not yet know any way of dating an instant in time related to the time span of metamorphism. The K–Ar dates in the Appalachian orogen are discussed in relation to the metamorphic veil.—E.S.L.

7574 **Arntson, R. H.; Dickson, F. W.; Tunell, G.** Stibnite (Sb_2S_3) solubility in sodium sulfide solutions: Science, v. 153, no. 3744, p. 1673–1674, illus., table, 1966.

The solubility of stibnite (Sb_2S_3) was measured at 25°C and 1 atm in solutions ranging from 0.45 to 7.16 percent Na_2S by weight. Sb_2S_3:Na_2S mole ratios of saturated solutions range from 0.238 to 0.403. Stibnite solubility increases at an increasing rate with rising Na_2S concentration. The reaction that best fits the experimental data is $2Sb_2S_3 + HS + OH = Sb_4S_7 + H_2O$, for which an equilibrium constant was estimated to be about 5.0.—Authors' abstract

Ashwell, I. Y. *See* Nelson, J. G. 7380

7625 **Aune, Quintin A.** Quick clays and California's clays—No quick solutions: California Div. Mines and Geology Mineral Inf. Service, v. 19, no. 8, p. 119–123, illus., 1966.

Information on quick clays in general and on the Bootlegger Cove Clay in Alaska and its relation to earthquake triggered landslides is reviewed. California does not have glacial quick clays but poorly consolidated clay-bearing formations containing saline waters could become dangerous if flushed by fresh water, especially if shaken by earthquakes. California's lesson from the Alaskan Good Friday earthquake should be that any change can breed instability in clay-bearing beds, and expansion and development of engineering structures on these beds should be accompanied by careful planning.—E.S.L.

7605 **Avent, Jon Carlton.** Cenozoic stratigraphy and structure of Pueblo Mountains region, Oregon-Nevada [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, p. 208B, 1966.

7491 **Bain, George L.; Thomas, J. D.** Geology and ground water in the Durham area, North Carolina: North Carolina Dept. Water Resources Ground-Water Bull. 7, 147 p., illus., tables, geol. map, 1966.

The Durham area is in the Piedmont province, mostly in the so-called Carolina slate belt. The slightly metamorphosed volcanic and sedimentary rocks are folded

and faulted, and intruded by igneous plutons, ranging from granite to gabbro; volcanic rocks are felsic to mafic in composition. Outside the slate belt are mica gneiss, mica schist, and hornblende gneiss, and younger rocks of Triassic age. Ground water is in secondary openings which are not necessarily related to any particular rock type or mapped unit, or in voids of soil and weathered rock. The potential yield at any one place is governed by rock type, depth of weathering, and topography; the two highest yields are in granodiorite and granite. Topographic slopes are the most dependable positions for wells. The chemical character of the water shows little relationship to rock units.—G.D.C.

7652 **Baird, Donald; Case, Gerard R.** Rare marine reptiles from the Cretaceous of New Jersey: Jour. Paleontology, v. 40, no. 5, p. 1211–1215, illus., 1966.

New finds from the Navesink greensand (Maestrichtian) of Burlington County, New Jersey, include the first known frontal bone of the mosasaurine lizard *Halisaurus platypondylus* and a vertebra of *Mosasaurus (Clidastes) conondon*. A peripheral bone of the toxochelyid saw-turtle *Prionochelys* demonstrates the survival of this genus into Maestrichtian time on the Atlantic seaboard.—Authors' abstract

Baird, Ralph W. *See* Blank, Horace. 7469

7254 **Baker, H. A.** Marten Hills area of Alberta [abs.]: Oilweek, v. 17, no. 30, p. 42, 1966.

Balsley, J. R. *See* Lindsley, D. H. 7347

Baltosser, Will W. *See* Rose, Arthur W. 7541

7237 **Bannatyne, B. B.** (compiler). Bibliography of geology, palaeontology, industrial minerals, and fuels in the post-Cambrian regions of Manitoba, 1958 to 1965: Manitoba Dept. Mines and Nat. Resources Mines Br. Pub. 66-1, 37 p., 1966.

This bibliography is supplementary to two similar reports, Pubs. 51-2 and 57-4. It is divided into three parts: in Part 1, the major references are listed alphabetically by author; in Part 2, the same references are listed according to subject, but only author and title are given; and in Part 3 other reports not listed in Parts 1 and 2, are listed by author or published under subject headings. The bibliography also contains special sections listing stratigraphic maps, articles on Hudson Bay area, radiocarbon dates, and Precambrian maps marginal to Paleozoic.—E.S.L.

Barakso, John. *See* Warren, Harry V. 7658

7401 **Barnes, David F.** Seismic, gravity, and magnetic measurements, Chap. 11 *in* Environment of the Cape Thompson region, Alaska: U.S. Atomic Energy Comm. Rept. PNE-481, p. 165–174, illus., table, 1966.

Geophysical support of the geologic mapping included (1) a seismic log indicating a vertical velocity of 14,000 feet/sec in test hole A, (2) a refraction profile that probably showed no higher velocity rocks shallower than 1,500 feet, (3) gravity measurements showing a regional Bouguer gradient indicating a decreasing thickness of the Colville geosyncline towards the west, (4) aeromagnetic traverses that did not yield reliable thicknesses for the geosynclinal sediments.—Author's abstract

Barnes, H. L. *See* Greenwood, H. J. 7339

7340 **Barnes, H. L.; Helgeson, H. C.; Ellis, A. J.** Ionization constants in aqueous solutions, Sec. 18 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 401–413, tables, 1966.

Only in the last decade have methods been developed for determining ionization constants in supercritical aqueous solutions; the usefulness of these constants in understanding hydrothermal, ionic equilibria has long been apparent. In the subcritical region, constants are given for several inorganic acids and bases likely to be of geologic interest. All ionization constants in these tables, derived from extrapolation of experimental data to infinite dilution, are reported as the logarithms

of thermodynamic constants, without dimensions. The degree of ionization of inorganic species in aqueous solution increases with increasing pressure at a constant temperature. Above 400°, with water the only known exception, ionization decreases at constant density with increasing temperature. Results of extrapolation from low temperature are questionable.—G.D.C.

7307 **Barnes, Robert H.; Wilson, Charles W., Jr.** Geologic map of the Alexandria quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 318-SE, scale 1:24,000, separate text, 1966.

The accompanying text, "Mineral resources summary of the Alexandria quadrangle, Tennessee," by D. S. Fullerton is cited separately.—M.C.M.

Barnes, Robert H. *See* Wilson, Charles W., Jr. 7635

Barnes, W. H. *See* Swallow, A. G. 7235

7398 **Bates, Robert G.** Aeroradioactivity survey of the Lisburne Peninsula and adjacent areas, Chap. 38 *in* Environment of the Cape Thompson region, Alaska: U.S. Atomic Energy Comm. Rept. PNE-481, p. 1115-1119, illus., 1966.

Radioactivity levels in a 1,000 sq mi area centered at Cape Thompson ranged from 50 to 750 counts/sec and averaged about 300 to 400 counts/sec. Highest values were recorded over exposed stream gravels and sand bars, and areas of good drainage and thin vegetation. The lower levels were obtained in swamp areas, as east of Point Hope, and in areas of thick vegetation. Results are shown on a map.—E.S.L.

7493 **Bates, Robert G.** Aeroradioactivity survey and areal geology of the Pittsburgh area, Pennsylvania, Ohio, West Virginia, and Maryland (ARMS-I): U.S. Atomic Energy Comm. Civil Effects Study CEX 59.4.12, 19 p., illus., 1966.

The survey area in western Pennsylvania, eastern Ohio, northern West Virginia, and western Maryland totals 14,400 sq mi and is centered on the greater Pittsburgh metropolitan area. Radioactivity levels range from 150-900 cps and average between 500 and 600 cps. Strata of Permian age have the highest radioactivity level and those of Mississippian age the lowest. Appalachian structural trends are reflected by linear radioactivity units in the southeastern corner of the survey area.—*from* Author's abstract

7543 **Bauer, Herman L., Jr.; Breitrick, Richard A.; Cooper, James J.; Anderson, James A.** Porphyry copper deposits in the Robinson mining district, Nevada, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 232-244, illus., tables, 1966.

From 1908 through 1963 the Robinson district produced almost one billion dollars worth of copper. About 15,000 feet of Paleozoic rocks are locally intensely folded and overturned, associated with thrust faulting. The trend of the monzonite intrusion and mineralization, perpendicular to the fault pattern, is believed due to an east-west lineation in the basement. Alteration and mineralization were contemporaneous with the intrusion and resulted from a single continuous deuteric process. The alteration exhibits vertical zoning, and the mineral assemblges and their chemical analyses are tabulated.—E.S.L.

Belsky, T. *See* Eglinton, G. 7457

7468 **Bendix-Almgreen, Svend Erik.** New investigations on *Helicoprion* from the Phosphoria Formation of south-east Idaho, U.S.A.: Kgl. Danske Vidensk. Selsk. Biol. Skr., v. 14, no. 5, 54 p., illus., 1966.

Ten specimens of the elasmobranch genus *Helicoprion*, representing *H. ferrieri* Hay, *H. ergasaminon* n. sp., *H. cf. ferrieri, and H.* undet. sp., were collected from bituminous phosphatic limestone boulders in the lower Phosphoria Formation in mines near Montpelier and Blackfoot, Idaho. General anatomy of the front part of the cranial capsule and the lower and upper jaw are described for the first two

species, and some previously unknown features are revealed. The compound tooth-spiral in the symphysis of the lower jaw is described in detail for all the species and its function is discussed. Tooth histoloty of *H. ferrieri* is discussed. The new anatomical and histological evidence indicates that *Helicoprion* is not closely related to the edestids or to any of the bradyodonts, but should be placed provisionally in its own order, close to the Selachii.—V.M.J.

7557 **Ben-Zvi, A.; Kinori, B. Z.; Neill, Charles R.** Abstracted bibliography on erosion of cohesive materials—Discussion [of paper 4746, 1966]: Am. Soc. Civil Engineers Proc., v. 92, Jour. Hydraulics Div., no. HY 5, p. 292–293, 1966.

The writers would like to add two abstracts relating to publications by Technion (Israel Institute of Technology), and a Russian reference by Karasev which has an English translation. In addition, three American publications are believed to be of importance for the problems of erosion of cohesive materials; these are cited in footnotes.—G.D.C.

7577 **Berg, Eduard.** Fundamental and applied research in seismology in Alaska: Alaska Univ. Geophys. Inst. [Rept. Ser.] UAG R-179, 44 p., illus., tables, 1966.

Two permanent stations and one semi-permanent have been established: Mount McKinley, Tanana, and Black Rapids; a number of additional stations have been operated during "Longshot". A catalog of earthquakes up to summer 1965 using all available sources has been compiled; energy release of the Aleutian Chain, Alaska and the southeast has been studied and mapped. Fault plane solutions from the main and a series of aftershocks of the March 28, 1964 earthquake indicate the predominant compressional force system is more or less directed perpendicular to the range; there is strong indication that the earthquake and aftershocks of magnitude ≥ 5.5 located on the continental shelf have possibly been triggered by low ocean tide loads. During the "Longshot" experiment, not only clear compressional P waves but also clear PcP waves have been observed in the distance range 1,800–2,600 km.—*from* Author's summary

7535 **Bergström, Stig M.; Sweet, Walter C.** Conodonts from the Lexington limestone (Middle Ordovician) of Kentucky, and its lateral equivalents in Ohio and Indiana: Bulls. Am. Paleontology, v. 50, no. 229, p. 271–441, illus., tables, 1966.

Seventy conodont form-species, comprising nearly 250,000 discrete specimens collected from 14 surface sections and two cores of Lexington Limestone of north-central Kentucky and its equivalents in Ohio and Indiana, are herein grouped and described as 32 single-element or multielement species. At least 23 (3 new) are regarded as natural or biologic species, and are designated by the oldest available form-species name. Biostratigraphic correlation of sections was done by logging of vertical fluctuations in relative abundance of the dominant species in the Lexington, *Phragmodus undatus*. Comparison of a master log for this region with other master logs shows correlation with the Rockland-Cobourg sequence (Trenton) of New York and Ontario, and the Decorah-Maquoketa sequence of Minnesota and Iowa. Recognition of multielement conodont species sheds new light on evolutionary development in well-known species.—V.M.J.

7373 **Berry, W. B. N.; Theokritoff, G.** Description and paleoecology of a Tremadoc dendroid graptolite from northern New York: Geol. Soc. America Bull., v. 77, no. 8, p. 873–877, illus., 1966.

A new species of *Dictyonema* from dolomitic sandstones close to the top of the Bucks Ridge Formation from a locality in the town of Potsdam, N. Y., is described; associated discoidal gastropods suggest a Tremadoc age. Ecological interpretation is that this dendroid was sessile-benthonic in clusters or "gardens" in a relatively shallow-water littoral environment, the bottom containing numerous tubes apparently formed by a tunneling organism.—Authors' abstract

7450 **Best, Myron G.** Structural geology of Precambrian rocks south of Bancroft, Ontario: Canadian Jour. Earth Sci., v. 3, no. 4, p. 441–455, illus., geol. map, 1966.

Structural analysis of the metamorphic rocks in this area has disclosed fold structures in lithologic layering, which are examined on the hypothesis that two generations are present. Folds of the first system, in the south, are fairly open, nearly recumbent, and plunge gently eastward, whereas folds of the second system, found in the north, are tighter, with steep southeast-dipping axial planes. Steep stratiform foliation and linear mineral segregations characterizing the terrain between the Hastings lowland and the Haliburton–Hastings highlands, seem to have evolved by progressive tightening of the second folds. The distinction between basin and highlands is one of predominant rock type, with progressive changes in structure between them. Formerly the distinction involved strongly contrasting structural characteristics, with intervening fault zones.—*from* Author's abstract

Bethke, Philip M. *See* Robie, Richard A. 7327

Binder, C. R. *See* Given, P. H. 7458

7329 **Birch, Francis.** Compressibility—Elastic constants, Sec. 7 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 97–173, tables, 1966.

Unless specified as linear, the tabulated data here refer to volume changes under pressure. The initial compressibility may be computed from the elastic constants. Methods of obtaining data under various conditions are discussed. In the tables for elastic constants of rocks a fair sampling of the literature, rather than exhaustive coverage, has been sought. Sampling is inadequate for estimates of the degree of variation in any geological or lithological unit, although uniformity on a small scale has been demonstrated. Application of any measurements should be made critically.—G.D.C.

7514 **Blackstone, D. L., Jr.** Pliocene vulcanism, southern Absaroka Mountains, Wyoming: Wyoming Univ. Contr. Geology, v. 5, no. 1, p. 21–30, illus., 1966.

A volcanic cone composed of volcanic ejecta and basalt flows is located in the southwest quarter of T. 45 N., R. 108 W., Park County. The base of the cone is at an elevation of 10,800 feet, and rests upon the Oligocene Wiggins Formation. Whole-rock analysis of the flow gave a K–Ar age of 3.6 (±1.0) m.y. or latest Pliocene. A geologic sketch map and cross sections are included. Analyses are tabulated.—E.S.L.

7469 **Blank, Horace; Knisel, Walter G.; Baird, Ralph W.** Geology and groundwater studies in part of the Edwards Plateau of Texas, including Sutton and adjacent counties: U.S. Agr. Research Service [Rept.] ARS 41-103, 40 p., illus., tables, 1966.

In this area, Lower Cretaceous limestones are designated as A,B,C, and D zones. Around Lowrey Draw in Sutton County exposures of zone D consist of hard, nearly pure limestones on the valley sides and ridges, and softer, nodular, marly limestones on the undissected plateau and lower parts of the valley. Dolomitic beds of zone C, the most important aquifer, have been found in wells. A broad syncline in Sutton County plunges gently southwestward, and a narrower one lies along the South Llano River, southeast of which strata drape over Edwards Arch and dip more steeply toward Balcones fault. Except for rudistid reefs, most limestones have little permeability, but transmit water through joints and solution openings. Permeability of dolomitic beds varies greatly; ground water is recharged through overlying jointed limestones and, under slight artesian head, discharges through numerous springs.—G.D.C.

Blench, Thomas. *See* Neill, Charles R. 7556

7538 **Bloom, Harold.** Geochemical exploration as applied to copper-molybdenum deposits, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 111–119, illus., tables, 1966.

Geochemical prospecting for porphyry copper-molybdenum deposits has been done on soils, waters, and vegetation in the southwestern United States. The average distribution of molybdenum is discussed. Since rhenium is associated with

molybdenite in the copper deposits, its geochemistry and mobility are included. Descriptions are given of primary and secondary halos.—E.S.L.

7263 **Bluck, Brian J.** Petrography of Devonian phosphates of Indiana: Illinois Acad. Sci. Trans., v. 59, no. 1, p. 43–47, illus., 1966.

In the Devonian rocks of Indiana phosphate occurs in thin bands either as an in situ replacement of limestones, or as a detrital constituent. Although some phosphate is nearly opaque and without recognizable texture, much is oolitic, with the ooliths having textures similar to their carbonate counterparts. Mineral associations include glauconite, pyrite, dolomite, calcite, and some fluorite. The phosphates are underlain by well sorted limestones and overlain, firstly by beds rich in crinoids to be followed by beds with bryozoa. It is concluded that these phosphate bands result from phosphate enrichment of the waters during regressions of the Devonian seas.—Author's abstract

7719 **Boissonneau, A. N.** Glacial history of northeastern Ontario—[Pt.] 1, The Cochrane–Hearst area: Canadian Jour. Earth Sci., v. 3, no. 5, p. 559–578, illus., 1966.

Surficial deposits, ice movements, and glacial lakes are described for an area of 42,000 sq mi. Field studies and air photograph interpretation suggest the following sequence of events: a major fan-shaped advance of an ice mass over the study area, withdrawal and the formation of proglacial lakes, and finally a minor readvance, the Cochrane, for which two phases are postulated. Lake stages in the Superior basin and Lake Barlow–Ojibway are included.—E.S.L.

Bottino, M. L. *See* Fairbairn, H. W. 7453

7519 **Boucot, A. J.; Johnson, J. G.** *Ehlersella*, a new Silurian stricklandiid brachiopod genus: Jour. Paleontology, v. 40, no. 3, p. 569–572, illus., 1966.

Stricklandia davidsoni Billings, and upper Llandovery stricklandiid species with a peculiar chevron-like ornament, is made type species of a new genus *Ehlersella*. The new genus is known from Anticosti Island and Gaspé to Alabama and Kentucky and is believed to have been derived from the widespread Llandovery-age genus *Stricklandia*. *"Stricklandinia" norwoodi* Foerste is redescribed from a large collection of well preserved specimens from the Red Mountain Formation of Alabama. Cardinal process lobes are developed on some of the latter specimens.—Authors' abstract

7517 **Boyd, Donald W.** Lamination deformed by burrowers in Flathead Sandstone (Middle Cambrian) of central Wyoming: Wyoming Univ. Contr. Geology, v. 5, no. 1, p. 45–53, illus., 1966.

The upper strata of the sandstone exposed in a road cut in Wind River Canyon contain abundant burrows with associated downbent laminae. The burrows are long, slender, sharply defined cylinders of sandstone normal to stratification. These deformed laminae can cause interpretive errors. Experiments suggest that the extent and type of downbending reflect subsurface removal of sediment rather than drag caused by downward penetration of the burrower.—E.S.L.

7589 **Boyle, R. W.; Tupper, W. M.; Lynch, J.; Friedrich, G.; Ziauddin, M.; Shafiqullah, M.; Carter, M.; Bygrave, K.** Geochemistry of Pb, Zn, Cu, As, Sb, Mo, Sn, W, Ag, Ni, Co, Cr, Ba, and Mn in the waters and stream sediments of the Bathurst–Jacquet River district, New Brunswick: Canada Geol. Survey Paper 65-42, 50 p., illus., tables, geol. map, 1966.

The western part of the district, in which the geochemical survey was carried out, is underlain by folded and faulted Ordovician–Devonian sediments and volcanics and four granitic bodies. The eastern part is underlain by relatively flat-lying Pennsylvanian sandstones and shales. The principal deposits are massive, vein, and disseminated sulfides, and molybdenite is associated with some granitic bodies. Most of the known mineral deposits and occurrences are plotted on the geochemical maps accompanying the paper. The heavy-metal content, cold-extractable heavy metals,

and each of the metals analyzed, except Sn, Co, and Cr, are shown on one of these maps, and the dispersion is discussed. Most of the known sulfide bodies are indicated by higher than normal heavy metals. Numerous streams with above normal heavy-metal content merit further study.—E.S.L.

7330 **Bradley, James J.; Fort, A. Newman, Jr.** Internal friction in rocks, Sec. 8 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 175–193, tables, 1966.

The term "internal friction" has been used frequently for nonelastic mechanisms that convert strain-energy into heat. Experimental results indicate that the damping of solids does not satisfy any general formula. A number of mechanisms suggested to explain the dissipation of energy are grouped into four main types: thermal, scattering, ferromagnetic, and frictional losses. Selected references are source material for the tabulated attenuation data. In preparing this table all values were converted to the equivalent "100b" value, the percent of stored energy lost per cycle. Knowledge of the variation of attenuation with frequency, temperature, and pressure is required to extrapolate laboratory data to conditions within the Earth, as in the second table.—G.D.C.

7539 **Brant, Arthur A.** Geophysics in the exploration for Arizona porphyry coppers, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 87–110, illus., tables, 1966.

Magnetic surveys and induced polarization are used most widely in exploration for porphyry coppers of Arizona. Under the first, a summary of survey results, some simple interpretive guides, and field examples are given. For induced polarization, the basis of the method, responsive minerals, systems of measurement, field procedures, and examples of field data are discussed. Accessory use has been made of electromagnetic, gravity, and AFMAG surveys, and these are described briefly.—E.S.L.

Breitrick, Richard A. *See* Bauer, Herman L., Jr. 7543

Brett, George W. *See* Weld, Betsy A. 7481

Brindley, G. W. *See* Rouxhet, P. G. 7434

Bromery, R. W. *See* Kane, M. F. 7320

Bromfield, C. S. *See* Bush, A. L. 7318

Brooks, Frank L. *See* Upshaw, Charles F. 7305

7465 **Brophy, John A.** A possible *Bison (Superbison) crassicornis* of mid-hypsithermal age from Mercer County, North Dakota: North Dakota Acad. Sci. Proc. 1965, v. 19, p. 214–223, illus., tables, 1966.

Detailed cranial measurements were made on two skulls found in a diversion cut being made in Spring Creek valley. Horn-core indices are compared with eight others, and on one specimen all fall within the range for *Bison (Superbison) crassicornis*, and all but one for the other. Wood associated with the skulls has been dated at 5,440±200 B.P. The measured section at the find is included.—E.S.L.

Brophy, John A. *See* Leighton, Morris M. 7663

7522 **Brower, James C.** Functional morphology of Calceocrinidae with description of some new species: Jour. Paleontology, v. 40, no. 3, p. 613–634, illus., 1966.

Calceocrinids (Crinoidea, Inadunata) adopted a recumbent, "runner" mode of life, with concommitant structural adaptions becoming increasingly refined through evolution. Six new species are described from the Ordovician and Silurian of Oklahoma, Illinois, Tennessee, Iowa, and Ontario, and the Mississippian of Indiana and Kentucky: *Calceocrinus constrictus, C. multibifurcatus, Grypocrinus multibrachiatus, Halysiocrinus septarmatus, H. springeri, and Calceocrinus pustulosus*

Johnson, previously unpublished. *Grypocrinus* is thought to be polyphyletic; *Halysiocrinus* is descended from *Deltacrinus* or its ancestor. Presence of *Calceocrinus* in the Black River Stage of Oklahoma reopens the question as to whether *Anulocrinus or Cremacrinus* is the ancestral stock of the Calceocrinidae.—R.E.G.

Brown, D. D. *See* Ferguson, S. A. 7408

Brunger, A. G. *See* Nelson, J. G. 7380

7651 **Brush, Grace S.** The absence of pollen and spores in some Triassic sediments: Jour. Paleontology, v. 40, no. 5, p. 1241–1243, 1966.

About 100 Triassic rock samples from 13 formations in the United States and eastern Canada were analyzed for fossil pollen and spores, with negative results. Reasons for the absence of plant microfossils in these sediments are briefly considered, and destruction by oxidation is suggested to be a main factor.—S.H.M.

7570 **Bryant, Donald G.; Metz, Harry E.** Geology and ore deposits of the Warren mining district, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 189–203, illus., 1966.

The general geology of the Warren district, Arizona, is given. Above the Precambrian Pinal Schist, the Paleozoic beds are Cambrian, Upper Devonian, and Mississippian–Permian. The Lower Cretaceous Bisbee Group was deposited on these, and the effect of fault movement on deposition of the basal Glance Conglomerate is discussed. Two groups of comagmatic igneous rocks were intruded in the Paleozoic Cretaceous interval, the most important being the Sacramento stock. These are described, along with intrusive breccias, whose origin is discussed. The Lavender Pit orebody is localized in the Sacramento complex by horsetailing of the Dividend fault. Limestone replacement deposits occur in all Paleozoic limestones, radiate outward from the stock in fracture and fault zones, and are closely associated with the intrusive breccias. The geologic history of the district is reviewed.—E.S.L.

7375 **Buck, Alan D.; Dolch, W. L.** Investigation of a reaction involving nondolomitic limestone aggregate in concrete [with French, German and Spanish summ.]: Am. Concrete Inst. Jour. Proc., v. 63, no. 7, p. 755–765, illus., tables, 1966.

A laboratory investigation was made on 17 limestones from 11 sources of a chemical reaction observed as rims on nondolomitic limestone coarse aggregate particles in field concrete. The rims were characterized by a color variation and an increased solubility in acid. The reaction was developed in three of the rocks in laboratory test specimens; X-ray diffraction analysis led to a tentative explanation. It was concluded that this reaction could occur with all carbonate rocks in concrete and could contribute to aggregate–paste bond.—*from* Authors' abstract

7386 **Bunce, Elizabeth T.; Hersey, J. B.** Continuous seismic profiles of the Outer Ridge and Nares Basin north of Puerto Rico: Geol. Soc. America Bull., v. 77, no. 8, p. 803–811, illus., 1966.

The shallowest layer on the outer ridge is nearly everywhere acoustically transparent, thinning outward in all directions. It corresponds to flat-lying strata in the Nares Basin. The next deeper structure consists of layers which in places are continuous, but elsewhere are more or less broken up. Interrupting these layers is a basement having relief of several hundred meters, outcropping as hills over parts of the outer ridge but buried about 1 km below the flat floor of the Nares Basin. The transparent layer may be the remnant of a continental rise predating the Puerto Rico Trench.—A.G.

Burgy, Robert H. *See* Lewis, David C. 7506

Burgy, Robert H. *See* Kriz, George J. 7553

Burgy, Robert H. *See* Kriz, George J. 7554

7271 **Burke, John G.** Origins of the science of crystals: Berkeley and Los Angeles, Calif., Univ. California Press, 198 p., illus., 1966.

In this review of the eventful background of classical crystallography prior to the discovery in 1912 of X-ray diffraction, a comprehensive examination is made of the science of crystals through late 18th and 19th-century development by the Abbé René Just Haüy and subsequent modifications. Theories concerning matter in general, and crystals in particular are described in sequence, including their classification, structure, chemistry and optics, and the concept of crystal symmetry.—G.D.C.

Burlingame, A. L. *See* Eglinton, G. 7457

Burnett, John L. *See* Matthews, Robert A. 7642

7653 **Burns, R. G.; Fyfe, W. S.** Distribution of elements in geological processes: Chem. Geology, v. 1, no. 1, p. 49–56, illus., 1966.

The generally accepted empirical rules of Goldschmidt, modified by Ringwood and Ahrens, concerning element distribution in geological processes and the controlling atomic properties are considered to lack generality and may fail to predict actual behaviour. The behaviour of transition elements frequently reflects crystal field influences which are a function of the chemistry and structural states of the systems considered and in many cases observed trends may be explained by crystal field theory. These considerations indicate that the magnitude and direction of fractionation of some element pairs may be radically changed in different chemical systems and existing rules cannot describe such changes.—Authors' summary

7300 **Burns, Robert E.** Free-fall behavior of small, light-weight gravity corers: Marine Geology, v. 4, no. 1, p. 1–9, illus., tables, 1966.

The increasing use of small, light-weight gravity corers equipped with free-fall devices, has raised the question of applicability of the optimum free-fall distance criteria originally established for large, heavy corers. Measurements have been made of the free-fall velocities of several devices representative of the class of small corers. These data indicate an optimum free-fall setting of 2–3 m, with general caution indicated on the minimum setting and specific caution indicated on the maximum for corers not fitted with stabilizing fins.—Author's summary

7318 **Bush, A. L.; Bromfield, C. S.** Geologic map of the Dolores Peak quadrangle, Dolores and San Miguel Counties, Colorado: U.S. Geol. Survey Geol. Quad. Map GQ-536, scale 1:24,000, section, 1966.

7571 **Bustamante, Jorge I.; Flores, Armando.** Water pressure on dams subjected to earthquakes: Am. Soc. Civil Engineers Proc., v. 92, paper 4954, Jour. Eng. Mechanics Div., no. EM 5, p. 115–127, illus., 1966.

A method is proposed to estimate the maximum hydrodynamic pressure in a two-dimensional reservoir subjected to horizontal earthquake motions. The method parallels the modal analysis ordinarily used for buildings. The hydrodynamic spectrum concept introduced herein results in curves that almost match the response spectra for sine, cosine, and El Centro 1940 ground motions; this suggests that ordinary damped spectra can be used for computing hydrodynamic water pressure.—Authors' abstract

Bygrave, K. *See* Boyle, R. W. 7589

7627 **California Division Mines and Geology.** Gravity map of Geysers area: California Div. Mines and Geology Mineral Inf. Service, v. 19, no. 9, p. 148–149, illus., 1966.

A preliminary Bouguer map is placed in open file at the Division, and a reduced version, showing generalized geology, is published with a brief text. A negative anomaly of about 20 mgal encompasses approximately 200 sq mi, centered near Mt. Hannah, in the south part of the Clear Lake volcanic field. The cause is not known, but some interpretations are given.—E.S.L.

7706 **Callahan, William H.** Genesis of the Franklin–Sterling, New Jersey, orebodies: Econ. Geology, v. 61, no. 6, p. 1140–1141, 1966.

The volcanic–sedimentary origin of modern Red Sea muds rich in iron, zinc, manganese and other metals "suggests a possible environment and process for deposition of. . . strata-bound oxide–silicate minerals of Fe, Zn, and Mn that characterize the Franklin–Sterling ore deposits."—W.S.W.

Calvin, M. *See* Eglinton, G. 7457

7324 **Cameron, A. G. W.** Abundances of the elements, Sec. 2 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 7–10, table, 1966.

Abundances of elements derived from various sources, including Sun and stars, are compiled to find the over–all composition of the solar system. Nonvolatile elements are commonly determined from chondritic meteorites, in which little fractionation has occurred. Elements in the Earth's crust apparently have been so fractionated and concentrated that determination of unfractionated abundances becomes difficult. Meteorites other than chondrites may have very different compositions. Inspection of the table shows that great uncertainties exist in many abundances. For elements such as indium, thorium, lead, and bismuth, levels in chondrites are much lower than expected; reasons for discrepancies are not well understood.—G.D.C.

7677 **Campbell, Charles V.** Truncated wave–ripple laminae: Jour. Sed. Petrology, v. 36, no. 3, p. 825–828, illus., 1966.

A common but seldom identified sedimentary structure which occurs in a variety of nearshore deposits is truncated wave–ripple laminae. This structure consists of sets of parallel laminae that were deposited conformably with the original wave–rippled surfaces but were partly eroded prior to deposition of the next set of wave–ripple laminae. Ripple wavelengths vary from 10 cm to 10 m and ripple indices from 4 to 17. Small–scale truncated wave–ripple laminae differ from the large–scale form only in size. A satisfactory mechanism for formation of the large–scale wave ripples is unknown.—Author's abstract

7228 **Campbell, Russell H.** Areal geology, Chap. 4 *in* Environment of the Cape Thompson region, Alaska: U.S. Atomic Energy Comm. Rept. PNE–481, p. 57–84, illus., geol. map, 1966.

About 350 sq mi in the Ogotoruk Creek area on the southwest side of Lisburne Peninsula was mapped. Exposed bedrock ranges in age from Early Mississippian to Cretaceous, and crops out in bands that are younger from west to east. All are marine, with some possible disconformities. Limestone and dolomite beds of the Lisburne Group, Mississippian, predominate in the west, and the east half is underlain by flysch–facies mudstone and sandstone of Cretaceous, and possibly Jurassic age. The structure of the western part is dominated by north–trending imbricate thrust faults, along which the Lisburne Group has been thrust eastward. The eastern part has been intensely folded and broken by high–angle faults, which are interpreted as a result of gravity gliding down a regional dip to the east in Late Cretaceous or early Tertiary time.—E.S.L.

7486 **Canada Geological Survey.** Alberta–British Columbia: Canada Geol. Survey Geol. Maps Index Sheet 83, scale 1:1,000,000, revised 1966.

7721 **Canada Geological Survey.** Aeromagnetic map, Tritop Peak, Yukon Territory: Canada Geol. Survey Geophysics Paper 3296, scale 1:63,360, 1966.

7722 **Canada Geological Survey.** Aeromagnetic map, Prospector Mountain, Yukon Territory: Canada Geol. Survey Geophysics Paper 3297, scale 1:63,360, 1966.

7723 **Canada Geological Survey.** Aeromagnetic map, Mount Pitt, Yukon Territory: Canada Geol. Survey Geophysics Paper 3298, scale 1:63,360, 1966.

7724 **Canada Geological Survey.** Aeromagnetic map, Black Creek, Yukon Territory: Canada Geol. Survey Geophysics Paper 3299, scale 1:63,360, 1966.

7725 **Canada Geological Survey.** Aeromagnetic map, Victoria Mountain, Yukon Territory: Canada Geol. Survey Geophysics Paper 3312, scale 1:63,360, 1966.

7726 **Canada Geological Survey.** Aeromagnetic map, Freegold Mountain, Yukon Territory: Canada Geol. Survey Geophysics Paper 3313, scale 1:63,360, 1966.

7727 **Canada Geological Survey.** Aeromagnetic map, Dark Creek, Yukon Territory: Canada Geol. Survey Geophysics Paper 3314, scale 1:63,360, 1966.

7728 **Canada Geological Survey.** Aeromagnetic map, Volcano Mountain, Yukon Territory: Canada Geol. Survey Geophysics Paper 3315, scale 1:63,360, 1966.

7729 **Canada Geological Survey.** Aeromagnetic map, Mount McDade, Yukon Territory: Canada Geol. Survey Geophysics Paper 3330, scale 1:63,360, 1966.

7730 **Canada Geological Survey.** Aeromagnetic map, Merrice Lake, Yukon Territory: Canada Geol. Survey Geophysics Paper 3331, scale 1:63,360, 1966.

7731 **Canada Geological Survey.** Aeromagnetic map, Minto, Yukon Territory: Canada Geol. Survey Geophysics Paper 3332, scale 1:63,360, 1966.

7732 **Canada Geological Survey.** Aeromagnetic map, Pelly Crossing, Yukon Territory: Canada Geol. Survey Geophysics Paper 3333, scale 1:63,360, 1966.

7733 **Canada Geological Survey.** Aeromagnetic map, Carmacks, Yukon Territory: Canada Geol. Survey Geophysics Paper 3348, scale 1:63,360, 1966.

7734 **Canada Geological Survey.** Aeromagnetic map, Yukon Crossing, Yukon Territory: Canada Geol. Survey Geophysics Paper 3349, scale 1:63,360, 1966.

7735 **Canada Geological Survey.** Aeromagnetic map, Ptarmigan Mountain, Yukon Territory: Canada Geol. Survey Geophysics Paper 3350, scale 1:63,360, 1966.

7736 **Canada Geological Survey.** Aeromagnetic map, Diamain Lake, Yukon Territory: Canada Geol. Survey Geophysics Paper 3351, scale 1:63,360, 1966.

7737 **Canada Geological Survey.** Aeromagnetic map, Rostoul Lake, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 4029, scale 1:63,360, 1966.

7738 **Canada Geological Survey.** Aeromagnetic map, Murdock Lake, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 4030, scale 1:63,360, 1966.

7739 **Canada Geological Survey.** Aeromagnetic map, Sabourin Lake, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 4031, scale 1:63,360, 1966.

7740 **Canada Geological Survey.** Aeromagnetic map, McCusker Lake, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 4032, scale 1:63,360, 1966.

7741 **Canada Geological Survey.** Aeromagnetic map, Onepine Lake, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 4033, scale 1:63,360, 1966.

7742 **Canada Geological Survey.** Aeromagnetic map, Stout Lake, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 4034, scale 1:63,360, 1966.

7743 **Canada Geological Survey.** Aeromagnetic map, Namiwan Lake, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 4035, scale 1:63,360, 1966.

7744 **Canada Geological Survey.** Aeromagnetic map, Cherrington Lake, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 4036, scale 1:63,360, 1966.

7745 **Canada Geological Survey.** Aeromagnetic map, Cobham Lake, Manitoba–Ontario: Canada Geol. Survey Geophysics Paper 4037, scale 1:63,360, 1966.

7746 **Canada Geological Survey.** Aeromagnetic map, Gorman Lake, Manitoba–Ontario: Canada Geol. Survey Geophysics Paper 4038, scale 1:63,360, 1966.

7747 **Canada Geological Survey.** Aeromagnetic map, Sheet 53 E/7, Manitoba: Canada Geol. Survey Geophysics Paper 4039, scale 1:63,360, 1966.

7748 **Canada Geological Survey.** Aeromagnetic map, Wapus Bay, Manitoba: Canada Geol. Survey Geophysics Paper 4040, scale 1:63,360, 1966.

7749 **Canada Geological Survey.** Aeromagnetic map, Island Lake, Manitoba: Canada Geol. Survey Geophysics Paper 4041, scale 1:63,360, 1966.

7750 **Canada Geological Survey.** Aeromagnetic map, Goose Lake, Manitoba: Canada Geol. Survey Geophysics Paper 4042, scale 1:63,360, 1966.

7751 **Canada Geological Survey.** Aeromagnetic map, Sheet 53 L/7, Manitoba: Canada Geol. Survey Geophysics Paper 4043, scale 1:63,360, 1966.

7752 **Canada Geological Survey.** Aeromagnetic map, Vermilyea Lake, Manitoba: Canada Geol. Survey Geophysics Paper 4044, scale 1:63,360, 1966.

7753 **Canada Geological Survey.** Aeromagnetic map, Knee Lake, Manitoba: Canada Geol. Survey Geophysics Paper 4045, scale 1:63,360, 1966.

7754 **Canada Geological Survey.** Aeromagnetic map, 17 Mile Lake, Manitoba: Canada Geol. Survey Geophysics Paper 4126, scale 1:63,360, 1966.

7755 **Canada Geological Survey.** Aeromagnetic map, Weaver Lake South, Manitoba: Canada Geol. Survey Geophysics Paper 4127, scale 1:63,360, 1966.

7756 **Canada Geological Survey.** Aeromagnetic map, Weaver Lake North, Manitoba: Canada Geol. Survey Geophysics Paper 4128, scale 1:63,360, 1966.

7757 **Canada Geological Survey.** Aeromagnetic map, Sheet 63 H/2, Manitoba: Canada Geol. Survey Geophysics Paper 4129, scale 1:63,360, 1966.

7758 **Canada Geological Survey.** Aeromagnetic map, Sheet 63 H/7, Manitoba: Canada Geol. Survey Geophysics Paper 4130, scale 1:63,360, 1966.

7759 **Canada Geological Survey.** Aeromagnetic map, Sheet 63 H/10, Manitoba: Canada Geol. Survey Geophysics Paper 4131, scale 1:63,360, 1966.

7760 **Canada Geological Survey.** Aeromagnetic map, Sheet H/15, Manitoba: Canada Geol. Survey Geophysics Paper 4132, scale 1:63,360, 1966.

7761 **Canada Geological Survey.** Aeromagnetic map, Molson Lake, Manitoba: Canada Geol. Survey Geophysics Paper 4133, scale 1:63,360, 1966.

7762 **Canada Geological Survey.** Aeromagnetic map, Lawford Lake South, Manitoba: Canada Geol. Survey Geophysics Paper 4134, scale 1:63,360, 1966.

7763 **Canada Geological Survey.** Aeromagnetic map, Lawford Lake North, Manitoba: Canada Geol. Survey Geophysics Paper 4135, scale 1:63,360, 1966.

7764 **Canada Geological Survey.** Aeromagnetic map, Sheet 63 I/15, Manitoba: Canada Geol. Survey Geophysics Paper 4136, scale 1:63,360, 1966.

Carter, M. *See* Boyle, R. W. 7589

7560 **Casagrande, Leo.** Subsoils and foundation design in Richmond, Va.: Am. Soc. Civil Engineers Proc., v. 92, paper 4915, Jour. Soil Mechanics and Found. Div., no. SM 5, p. 109–126, illus., tables, 1966.

The engineering properties of the subsoil in Richmond, Va., are analyzed on the basis of laboratory tests of undisturbed samples. It is shown that the strength of the massive clay and sand–clay strata is several times greater than had been assumed because of the small standard penetration resistance and the soft consistency of spoon samples. Only locally, where some recent clay deposits are not preconsolidated by surface drying, it is considered essential that in the design of heavy buildings, problems involving total and differential settlements are taken into consideration. Representative examples of heavy–building foundations are studied and it is emphasized that the driving of long piles through sensitive clay soils may not only be unnecessary but may result in unforseen difficulties.—Author's abstract

Case, Gerard R. *See* Baird, Donald. 7652

Charlesworth, H. A. K. *See* Muecke, G. K. 7647

7473 **Cheesman, R. L.** (and others). Summary report of geological surveys conducted in the Precambrian area of Saskatchewan, 1965: [Regina] Saskatchewan Dept. Mineral Resources, Geol. Sci. Br., 29 p., illus. [1966?].

In 1965 in Saskatchewan, six field parties were engaged in mapping regular fifteen–minute quadrangles and one party continued detailed study in the MacKay–Sulphide Lakes area. Mapping of mineralization of potential economic interest included known gold deposits in the Mirabelli Lake area, indications of copper in the Kelly Lake area, and copper, gold, zinc, and possibly asbestos in the Oskikebuk–Viney Lakes area. Other areas mapped were Nemei Lake, Nekweaga Bay, Stanley, and Harper Lake.—E.S.L.

7370 **Cherry, R. N.** Chloride content of ground water in Pinellas County, Florida, in 1950 and 1963: Florida Board Conserv. Div. Geology Map Ser., no. 20, scale about 1 in. to 4 1/2 mi., text, 1966.

Salt–water encroachment has occurred in many coastal areas of Florida and may be defined as present–day movement of salt water into the unconfined and/or confined fresh water. Chloride, principal constituent of salt water, can be used to measure degree of salinity. Inset maps illustrating chloride content in 1950 and 1963 for well depths 0–125, 126–250, and greater than 250 feet show that no significant salt–water encroachment has occurred in Pinellas County during this period, probably due to no large increase in water withdrawals. Most water supplied to larger municipal systems in the county is pumped from wells in northeastern Pinellas and western Hillsborough Counties. Large wells formerly used for irrigation of orange groves have been abandoned because land is used for housing projects. Water with less than 250 ppm chloride occurs in much of the county.—M.C.M.

7466 **Chinburg, Wayne; Holland, F. D., Jr.** Report of the Oligocene rhinoceros, *Subhydracodon*, in North Dakota [abs.]: North Dakota Acad. Sci. Proc. 1965, v. 19, p. 213, 1966.

Chinner, G. A. *See* Schreyer, W. 7667

7650 **Clark, John.** Status of the generic names *Metacodon* and *Geolabis* [insectivore]: Jour. Paleontology, v. 40, no. 5, p. 1248–1251, 1966.

The genus *Geolabis* is believed to be undeterminable because: (1) The type specimen of the type species *G. rhynchaeus* cannot surely be synonymized with or excluded from synonymy with any of two species of *Metacodon*, one of *Ankylodon*, and one unnamed but described specimen; (2) it is impossible to determine whether the type specimens of *G. rhynchaeus* are congeneric with each other, with *Metacodon*, or with *Ankylodon*; (3) the parts preserved in the syntype specimens do not offer dependable generic or specific characters in recent erinaceoids. In the absence of a determinable synonym, the name *Metacodon* is valid.—F.C.W.

7322 **Clark, Sydney P., Jr.** (editor). Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, 587 p., illus., tables, 1966; originally published 1942.

Thirty contributors for 27 chapters were selected for revision of the first edition of this book (Spec. Paper 36, edited by Birch, Scherer, Spicer, 1942); most of these are cited individually. Introductions to sections are brief, and in the text, to encourage a critical attitude, measurements by different observers of ostensibly the same physical properties have been included. It is hoped that this new compilation will draw attention to areas where more adequate data are needed.—G.D.C.

7323 **Clark, Sydney P., Jr.** Composition of rocks, Sec. 1 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, , illus., table, 1966.

This section deals mainly with petrological terminology for the nongeologist; only the principal types of rock are mentioned. The igneous rocks are divided into plutonic and volcanic types and a generalized variation in their mineralogic composition is diagrammed. A table gives average chemical analyses of certain types of plutonic rocks. Sedimentary and metamorphic rocks have not been as extensively studied by petrographers nor classified in as much detail as igneous rocks. Clastic rocks, classified by grain size, are relatively porous and their chemical sediments more dense. Changes in the bulk composition may be caused by metamorphism, the most conspicuous being dehydration with higher grades of metamorphism. Physical properties of metamorphic rocks are mainly determined by the properties of their constituent mineral.—G.D.C.

7325 **Clark, Sydney P., Jr.** Isotopic abundances and 1961 atomic weights, Sec. 3 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 11–17, table, 1966.

Isotopic abundances have been taken from the compilation by Strominger, Hollander, and Seaborg (Rev. Modern Physics, v. 30, p. 585, 1958); their tabulated values have been rounded to the nearest 0.1 percent, except in cases of very rare isotopes. The natural isotopic variation may exceed this. Atomic weights are on the C–12 scale.—Author's introduction

Clark, Sydney P., Jr. *See* Daly, R. A. 7326

7334 **Clark, Sydney P., Jr.** Viscosity, Sec. 12 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 291–300, illus., tables, 1966.

Viscosity is defined as the ratio of shearing stress to rate of shear. The unit of kinematic viscosity is the stokes, the viscosity in poises divided by the density of gm/cm^3. For many liquids viscous flow is a simple activated process, and the viscosity is well represented as a function of temperature. Such a law is fairly well obeyed by SiO_2 and by some binary barium silicates; viscosities of other silicate liquids can be represented by a sum term. Viscosities have been determined in the field by observing rate of flow of lava streams; results are subject to uncertainty by the possible presence of dissolved gases and crystals, which complicates comparison with laboratory results.—G.D.C.

Clark, Sydney P., Jr. *See* Kracek, F. C. 7335

7337 **Clark, Sydney P., Jr.** High-pressure phase equilibria, Sec. 15 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 345–370, illus., tables, 1966.

Recent expansion of literature on effects of high pressure has made possible a complete revision of this section. Confined to materials of geologic interest, most of the data are in the form of lines of univariant equilibria projected into the pressure–temperature plane. Multivariant equilibria have been less studied; work on clay minerals and zeolites was largely omitted because many are stable only at low temperatures. In compiling the tables a critical selection of data has been attempted to avoid insufficiently reliable results. Virtually all data given were obtained from direct studies of phase equilibria at high pressures and temperatures. Some phase diagrams are included.—G.D.C.

7341 **Clark, Sydney P., Jr.** Solubility, Sec. 19 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 415–436, illus., tables, 1966.

This section summarizes the small amount of available data on solubility at high temperatures and pressures. Data are given for solubility of solids in water (or water rich solutions) and for solubility of water in silicate melts. Emphasis has been on materials of geological interest, but a few substances uncommon in nature have been included. Little of the systematic experimental work has been on systems of a complexity approaching those to be found in nature. Several methods developed for determination and measurement are very briefly outlined. A general statement about the accuracy of the tabulated data is difficult to make; the last figure given is always uncertain, but by unknown amounts.—G.D.C.

7343 **Clark, Sydney P., Jr.** Thermal conductivity, Sec. 21 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 459–482, tables, 1966.

In isotropic homogeneous material heat conduction depends on a single constant, actually a function of temperature, pressure and other variables. Rocks are not homogeneous; their constituent crystals are predominantly of low symmetry. If no large-scale departures from isotropy exist, a single conductivity determined from a large enough sample suffices to give the relationship between average heat flow and average thermal gradient. Such factors as bedding, schistosity, and fracturing may introduce marked differences in conductivity in different directions. In the revised table of data on the thermal conductivity of rocks at room temperature values are means of groups; discrepancies are startling.—G.D.C.

Clark, Sydney P., Jr. *See* Lee, W. H. K. 7344

7346 **Clark, Sydney P., Jr.; Peterman, Zell E.; Heier, Knut S.** Abundances of uranium, thorium, and potassium, Sec. 24 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 521–541, illus., tables, 1966.

These three elements receive special attention because their radioactivity gives them unique importance to the thermal budget of the Earth and other terrestrial planets. Their abundances in meteorites, igneous and sedimentary rocks, and sediments are tabulated; those in silicic igneous rocks are summarized in histograms. Data on metamorphic rocks are insufficient for tabulation. Data on potassium are tabulated separately from those on uranium and thorium because, as a major element, its determination is by different methods and for different purposes. Systematic errors in old uranium and thorium analyses and recent potassium analyses are the most serious in materials of low concentrations such as ultramafic rocks and meteorites.—G.D.C.

7260 **Clowes, R. M.; Kanasewich, E. R.; Cumming, G. L.** Deep crustal seismic reflections at near-vertical incidence [abs.]: Oilweek, v. 17, no. 30, p. 33–34, 1966.

7628 **Coan, Eugene; Roth, Barry.** The West American Marginellidae: Veliger, v. 8, no. 4, p. 276–299, illus., table, 1966.

Taxonomy of the marginellid gastropods of the Pacific coast of North and South America (Cenozoic, Pliocene to Recent), is reviewed. Description of each species includes discussion of analogous species found in the Caribbean region.—V.M.J.

7288 **Cocke, J. M.** Studies of Pennsylvanian corals in Oklahoma—Pt. 2, New species of *Dibunophyllum* from the Dewey Formation: Oklahoma Geol. Survey Circ. 72, p. 35–56, illus., table, 1966.

Dibunophyllum brucei, new species, occurs in the lower thin limestones and calcareous shales and *Dibunophyllum oklahomense*, new species, in the upper thin limestones and calcareous shales of the Dewey Formation, Missourian Series, northeastern Oklahoma. Earliest stages of both species show the counter and cardinal septa insert as a single crossbar. Counter lateral septa enter before alar septa.—Author's abstract

7371 **Cole, W. Storrs.** Additional comments on the foraminiferal genus *Camerina*: Bulls. Am. Paleontology, v. 50, no. 228, p. 229–265, illus., 1966.

Camerina Bruguière, 1792, was suppressed (ICZN, 1945, Op. 192) in favor of its junior synonym *Nummulites* Lamarck, 1801, after 18 years of indecision by the Commission on Zoological Nomenclature. This ruling, based on use of convenience, was unjustified and should not be accepted. Analysis of the pattern and elements of the test of certain camerinids with undivided median chambers demonstrates that these species cannot be assigned to "form" genera with definite stratigraphic ranges but belong to *Camerina* which has a stratigraphic range from Paleocene to Recent (Cole, 1960).—Author's abstract

7381 **Coleman, A.; Henoch, W. E. S.** Geography in the field—A sample traverse in South Gloucester, Ontario: Canadian Geographer, v. 10, no. 2, p. 82–93, illus., 1966.

This paper is intended as an illustration of field methodology for teachers at large, and as the description of a specific opportunity for teachers in Ottawa. The area selected is an outcrop of Lower Ordovician rock, two miles long, projecting through glacial and postglacial deposits. It is on the upthrown side of the Gloucester fault, whose scarp is developed in three formations; Champlain Sea deposits are present, as well as till. This geologic background is correlated with land use; farms have deteriorated but quarries and brickworks have succeeded. The direction of glacial movement can be interpreted from striae and friction cracks.—E.S.L.

7606 **Coleman, James Malcolm.** Coastal sediments and late Recent rise of sea level, Vermilion, Iberia, and St. Mary Parishes, Louisiana [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, p. 208B, 1966.

Compton, J. R. *See* Stanley, D. J. 7390

Condon, W. H. *See* Hoare, J. M. 7363

Cook, Annan. *See* Robinson, R. F. 7565

7573 **Cook, John C.** Seismic delineation of solution cavities, *in* Symposium on salt, 2d—V. 2, Rock mechanics, geophysics, evaporated salt, solution mining, underground storage: Cleveland, Ohio, Northern Ohio Geol. Soc., p. 131–139, illus., 1966.

For engineering management of solution cavities in bedded salt or other evaporites, knowledge of cavity outlines is needed from time to time. Downhole methods are not fully successful in surveying the thin, lenticular cavities common in bedded evaporites. A new type of surface seismic-reflection surveying has been tested for this purpose; large seismic amplitude anomalies should be found above flooded solution cavities. Results from the majority of field experiments, performed over two years of research, were negative, mostly because of unfavorable geology. Nevertheless, excellent cavity indications were obtained using the "seismic shadow" technique and normalized amplitudes. Solution cavities at a depth of 1,500 feet were apparently delineated with a lateral precision of around 15 feet. Further testing and development of this method is recommended.—*from* Author's abstract

7579 **Cooper, J. A.; Richards, J. R.** Lead isotopes and volcanic magmas: Earth and Planetary Sci. Letters, v. 1, no. 5, p. 259–269, illus., tables, 1966.

Lead isotope measurements on 25 modern volcanic extrusives (Hawaii 18, Japan 5, Reunion Island 2) indicate a complicated geological history for the source region. The key assumption is that the sources of all volcanics may be treated as a single unit with respect to time variations of U and Pb abundances. Attempts at regression analysis are inconclusive, and interpretation by comparison with synthetic limiting fields suggests that the first differentiation of the mantle occurred 2,800 m.y. ago. A possible mechanism for heterogeneous redistribution is discussed. The fact that massive lead orebodies appear to have a homogeneous source may mean that concentration takes place at greater depths than magma formation.—E.S.L.

Cooper, James J. *See* Bauer, Herman L., Jr. 7543

7428 **Cooper, Laurence C.** Obsidian: Earth Sci., v. 19, no. 4, p. 157–159, illus., 1966.

The nature of glass as contrasted with mineral is discussed, and types of obsidian described. Most obsidian is related to rhyolite and granite in composition and occurs usually as marginal parts of more crystalline flows. It is questionable as to where the line should be drawn between welded tuffs and volcanic glass and rhyolites.—E.S.L.

Corliss, J. B. *See* Inman, D. L. 7385

Courtright, James H. *See* Richard, Kenyon. 7568

Crawford, Jack W. *See* Holland, F. D., Jr. 7467

7406 **Creager, Joe S.; McManus, Dean A.** Geology of the southeastern Chukchi Sea, Chap. 26 *in* Environment of the Cape Thompson region, Alaska: U.S. Atomic Energy Comm. Rept. PNE-481, p. 755–786, illus., table, 1966.

The bottom of the southeastern Chukchi Sea is a gently dipping plain with gradients ranging from 50 feet per mile to tenths of feet per mile. Well-developed shoals project northward from Cape Prince of Wales and northwestward from Point Hope. A newly discovered submarine valley heads between Kivalina and Cape Thompson and trends westward. The bottom sediments are from two sources: the cliffs near Cape Thompson and the area south of Bering Strait. Sediment from the latter source is brought into the Chukchi Sea by the strong current setting northward through Bering Strait. The distribution of sediment is controlled by the physical factors of bottom topography, proximity of source, currents, and waves.—Authors' abstract

7562 **Creasey, S. C.** Hydrothermal alteration, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 51–74, illus., tables, 1966.

Strong hydrothermal alteration accompanied the metallization of the Southwest porphyry coppers, but no two deposits are exactly alike. Some common features are described. Experimental data bearing on the alteration are presented, accompanied by graphs showing stability relations and equilibrium curves. Three principal types of alteration are recognized in the porphyries: propylitic, argillic, and potassic. Hydrothermal alteration in nine Arizona districts or deposits is discussed, and summarized in a table.—E.S.L.

Creath, Wilgus B. *See* Upshaw, Charles F. 7305

7452 **Crickmay, C. H.** The external apical cavity of strophomenacean brachiopods: Canadian Jour. Earth Sci., v. 3, no. 4, p. 499–508, illus., 1966.

Large collections of strophomenacean brachiopods from many Ordovician and Silurian localities have been searched for specimens with uneroded beaks. A few have been found, and these have been prepared in sagittal section. The apical cavity is found to have no primal exterior opening. Therefore, it cannot be interpreted as a vestigial pedicle foramen. It seems, rather, to be a vacuity formed for no special function but merely incidentally during the early stages of shell making.—Author's abstract

7291 **Cridland, Arthur A.; Williams, Janet L.** Plastic and epoxy transfers of fossil plant compressions: Torrey Bot. Club Bull., v. 93, no. 5, p. 311–322, illus., 1966.

[John] Walton's [(1923) balsam] transfer technique has been modified for use with polyester plastics and epoxy resins. Besides conferring conveniences in handling and processing, these materials allow the preparation of large size transfers.—Authors' abstract

Cumming, G. L. *See* Clowes, R. M. 7260

Cupps, C. Q. *See* Hamke, J. R. 7433

7382 **Curl, Rane L.** Discussion regarding "Mischungskorrosion": Cave Notes, v. 8, no. 3, p. 22–23, 1966.

The work of Franke, Bögli, and Howard on "Mischungskorrosion" is reviewed. The first two authors have applied this process to certain cave forms. Curl feels that more work should be done, as there may be other peculiar phenomena not yet discovered. He has made some calculations for mixing of unsaturated streams.—E.S.L.

7241 **Curtis, G. H.** The problem of contamination in obtaining accurate dates of young geologic rocks, *in* Potassium argon dating: New York, Springer-Verlag, p. 151–162, 1966.

The K–Ar system of dating has had an almost unique position in dating geologically young events. Contamination added to a sample at the time of its formation, the high amount of air incorporated in authigenic minerals, the initial radiogenic Ar that may occur in igneous minerals, and contamination from old potassium-bearing minerals are examined. The two major types of igneous processes causing fragmentation leading to formation of tuff are described preliminary to a discussion of the recognition of foreign-mineral contamination of tuff samples. Contamination from reworking of primary tuffs by erosion is also a factor.—E.S.L.

7649 **Daily, Fay Kenover; Durham, J. Wyatt.** Miocene charophytes from Ixtapa, Chiapas, Mexico: Jour. Paleontology, v. 40, no. 5, p. 1191–1199, illus., 1966.

Unnamed nonmarine, partly tuffaceous strata near Ixtapa, Chiapas, Mexico, contain fresh-water mollusks, land mammals, well-preserved leaves and charophytes. The vertebrates indicate a probable late Miocene age for the section, part of which is of lacustrine origin. The charophytes *Charetes strobilicarpa* var. *ellipsoidea* (Reid and Groves) Daily, *Croftiella ovalis* subsp. *mexicana* Daily n. subsp. and *Tectochara ixtapensis* Daily n. sp. are described.—S.H.M.

7326 **Daly, R. A.; Manger, G. Edward; Clark, Sydney P., Jr.** Density of rocks, Sec. 4 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 19–26, tables, 1966.

Tabulations by Daly show average densities of holocrystalline igneous rocks and natural glasses, and artificially prepared crystalline rock and corresponding glass. Porosity and bulk density, dry and saturated, of sedimentary rocks are compiled by Manger. Porosity is expressed as either total or apparent; the method of determination may affect porosity values. Average densities of metamorphic rocks, of which there seem to be few systematic studies, are compiled by Clark. The fact that geologists tend to classify metamorphic rocks on a stratigraphic basis, rather than on mineralogy, complicates such a compilation. The mineralogy of a formation, dependent on grade of metamorphism, varies from place to place and may be further complicated by banding.—G.D.C.

7590 **David, Peter P.** The late-Wisconsin Prelate Ferry paleosol of Saskatchewan: Canadian Jour. Earth Sci., v. 3, no. 5, p. 685–696, illus., tables, 1966.

The Prelate Ferry paleosol is known at five localities in the tributaries of the South Saskatchewan Valley, and the type section is 8 mi north of Prelate. The paleosol developed on the lower till and is buried by 120 feet of sediments comprising two till sheets and three beds of stratified drift. The nonglacial Prelate Ferry interval had a local climate similar to that of today. The beginning of the interval is not known, but it ended about 20,000 years ago, when the last major ice advance occurred. The paleosol is pollen-sterile; it shows an upward decrease in grain size; is weathered, noncalcareous in most parts; and is slightly to strongly alkaline. It has a clay-mineral content similar to that of the underlying till.—*from* Author's abstract

7641 **Davis, R. W.** Availability of ground water in the Lovelaceville quadrangle, Jackson Purchase region, Kentucky: U.S. Geol. Survey Hydrol. Inv. Atlas HA-172, scale 1:24,000, section, text, 1966.

Most wells in the Lovelaceville quadrangle are less than 200 feet deep and obtain ground water from sand of Eocene age. A few wells in the bottom land areas may obtain some water from alluvial deposits. Yields from wells in the Eocene sand vary from 100–500 gpm. Present withdrawals of ground water are insignificant compared to the large amount in storage. Quality of water is good.—M.C.M.

7429 **Davison, W. L.** Caribou River map-area, Manitoba: Canada Geol. Survey Paper 65-25, 6 p., geol. map, 1966.

Caribou River area lies northwest of Churchill, on the west side of Hudson Bay. Bedrock is entirely Precambrian, and is characteristic of the Churchill Structural Province of the Canadian Shield. Oldest rocks, granitic and metasedimentary hypersthene-bearing granulites, are overlain by metamorphosed stratified rocks, which include paragneiss, quartzite, schist, basalt, and greenstone. The stratified rocks are intruded by quartz diorite and by later porphyritic granite. A younger sedimentary sequence is assigned to the Great Island Group. Glacial deposits include eskers and washboard moraines. Raised beaches and wave-formed terraces are present through the area.—*from* Author's abstract

7583 **Dawson, Mary R.** Additional late Eocene rodents (Mammalia) from the Uinta Basin, Utah: Carnegie Mus. Annals, v. 38, art. 4, p. 97–114, illus., tables, 1966.

Five specimens of rodent jaw fragments with teeth are described from the late Eocene of the Uinta Basin, Uintah County, Utah: the paramyids *Microparamys dubius*, formerly considered a sciuravid, and *Janimus rhinophilus*, n. gen., n. sp.; *Sciuravus popi*, n. sp., and *Sciuravus* cf. *S. popi*, all from the Wagonhound and Myton Members of the Uinta Formation; and a sciuravid or myomorph molar, possibly related to *Simimys*, from the Randlett Member of the overlying Duchesne River Formation. Relations to other species and evolutionary trends are discussed. A complete distribution list of late Eocene rodents of the Uinta Basin is given, with references.—V.M.J.

Delavault, Robert E. *See* Warren, Harry V. 7658

7688 **DeMar, Robert E.** *Longiscitula houghae*, a new genus of dissorophid amphibian from the Permian of Texas: Fieldiana—Geology, v. 16, no. 2, p. 45–53, illus., 1966.

A new genus and species of Dissorophidae, *Longiscitula houghae*, is described from "E. C. Olson's *Broiliellus* pocket" in the Arroyo Formation, Clear Fork Group, at Coffee Creek, Baylor County, Tex. The two known specimens give information on the skull only from the dorsal and lateral views, and on part of the armor behind the skull. The posterior part of the skull and the otic notch are well preserved; the part anterior to the orbits is considerably crushed. Comparisons of skull measurements with *Dissorophus*, *Cacops*, *Trematops*, reveal a mixture of dissorophid and trematopsid features in *Longiscitula*, emphasizing close relationship of the two families. The armor of the three dissorophid genera, however, is not homologous, and apparently evolved separately for each as they adopted terrestrial life.—V.M.J.

7689 **DeMar, Robert E.** The phylogenetic and functional implications of the armor of the Dissorophidae: Fieldiana—Geology, v. 16, no. 3, p. 55–88, illus., 1966.

Phylogeny and taxonomy of the amphibian family Dissorophidae are considered in light of morphology of the dorsal dermal ossifications, called armor, which evolved in previously unarmored aquatic forms during Late Pennsylvanian or earliest Permian time. Early Permian species of *Broiliellus*, *Dissorophus*, *Aspidosaurus*, *Cacops*, *Alegeinosaurus*, from terrestrial beds of Texas and New Mexico were examined. The internal series of armor, which developed earlier than the external series, is not homologous between the dissorophine group (first two genera), and aspidosaurine group (last three), although the external armors look similar. Skull and sacral-rib differences also suggest that the groups evolved separately. Terrestrial

adaptation could not be the single cause of armor development; however, armor could have served as a mechanism to prevent drying.—V.M.J.

Dickson, F. W. *See* Arntson, R. H. 7574

Dill, Robert F. *See* Shepard, Francis P. 7394

Dineley, D. L. *See* Tuke, M. F. 7592

7369 **Dionne, Jean-Claude.** Un type de buttes gazonnées [with English abs.]: Rev. Géomorphologie Dynamique, v. 16, no. 3, p. 97–100, illus., 1966.

Observations have been made on an unusual type of earth grass mounds [on the south coast of the St. Lawrence estuary] similar to arctic forms called thufur. These forms located on a marine silty clay terrace seem to result from the upheaving by frost of "glaciel" cristalline boulders.—Author's abstract

7540 **Dixon, D. W.** Geology of the New Cornelia mine, Ajo, Arizona, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 123–132, illus., 1966.

The pit rocks of New Cornelia mine fall into two groups, separated through the center of the pit by Charlie fault, a north-south fault with steep dip to the east. Rocks on the west, in the footwall, are hard massive quartz monzonite, with bornite-chalcopyrite mineralization and weak hydrothermal alteration. Rocks in the hanging wall block, on the east, are soft quartz monzonite, quartz diorite, and rhyolite, with abundant flow sheeting and strong hydrothermal alteration. Mineralization is pyrite and chalcopyrite. There were two widely separated periods of oxidation and enrichment, the first in middle Tertiary when the rhyolite capping was oxidized, the second developing on the present erosion surface.—E.S.L.

Doberenz, A. R. *See* Haynes, C. Vance, Jr. 7534

Dolch, W. L. *See* Buck, Alan D. 7375

Donnay, Gabrielle. *See* Donnay, J. D. H. 7233

7233 **Donnay, J. D. H.; Donnay, Gabrielle.** Errata in *International tables for X-ray crystallography*—V. II, Mathematical tables (1959): Acta Cryst., v. 21, pt. 3, p. 431, 1966.

In section 3.1.9.3, the transformation formulas, valid as given only in orthogonal axes, have been amended for use also if the coordinate system is not orthogonal.—G.D.C.

7664 **Dott, R. H., Jr.** Eocene deltaic sedimentation at Coos Bay, Oregon: Jour. Geology, v. 74, no. 4, p. 373–420, illus., 1966.

Based on gross lithologies, facies relations, sedimentary structures, petrography, and faunas, the late Eocene paleogeographic history is interpreted as offshore-marine, deltaic, and coal swamp environments that migrated steadily north-northwest into a broad open embayment of the Pacific Ocean. The climate was subtropical, with abundant land vegetation. The poorly sorted and mineralogically heterogeneous sediment, derived from the active volcanic area of the Klamath region to the south-southeast, was transported 40–50 miles across a coastal plain. Generally, the Eocene Coaledo Formation and related rocks consist of sediments of volcanic (50 percent), sedimentary (30 percent), and metamorphic (20 percent) origin. Later Cenozoic deformation and volcanism, termed the Cascadan orogeny, resulted in the faulted synclinorium of southwest Oregon.—V.E.S.

Drake, C. L. *See* Sheridan, R. E. 7694

Dreimanis, A. *See* Quigley, R. M. 7585

Duce, R. A. *See* Woodcock, Alfred H. 7439

7374 **Dunbar, Carl O.** Memorial to Lauge Koch (1892–1964): Geol. Soc. America Bull., v. 77, no. 8, p. P145–P154, portrait, 1966.

7552 **Duncan, James M.; Seed, H. Bolton.** Anisotropy and stress reorientation in clay: Am. Soc. Civil Engineers Proc., v. 92, paper 4903, Jour. Soil Mechanics and Found. Div., no. SM 5, p. 21–49, illus., tables, 1966.

The mechanism is examined by which both anisotropy and stress reorientation may cause undrained strength of clay to vary with orientation of failure plane. Because magnitude of change in stress required to cause undrained failure in clay depends on amount of reorientation of principal stress directions, so also does magnitude of changes in pore-water pressure, and thus the magnitude of effective stresses. The influence of stress reorientation on undrained strength may be analyzed, provided values of strength parameters in terms of effective stresses and pore pressure parameters are known which would apply to various orientations of principal stresses at failure. Test results show that kaolinite is practically isotropic with respect to values of strength parameters in terms of effective stress, but is anisotropic with respect to values of the pore pressure parameters.—*from* Authors' abstract

7580 **Dunham, K. C.** Lawrence Rickard Wager [1904–1965]: Geochim. et Cosmochim. Acta, v. 30, no. 8, p. 839–840, 1966.

Durek, J. J. *See* Moolick, R. T. 7529

Durham, J. Wyatt. *See* Daily, Fay Kenover, 7649

7384 **Eade, K. E.** Kognak River (west half), District of Keewatin: Canada Geol. Survey Paper 65-8, 12 p., table, geol. map, 1966.

The Precambrian stratigraphy and petrology of this map area, within the Churchill structural province of the Canadian Shield, are discussed with brief mention of structure and economic geology.—E.S.L.

7682 **Eade, K. E.; Fahrig, W. F.; Maxwell, J. A.** Composition of crystalline shield rocks and fractionating effects of regional metamorphism: Nature, v. 211, no. 5055, p. 1245–1249, illus., tables, 1966.

The relations between chemical composition and metamorphic grade, and the average regional composition of rocks from New Quebec, Canada, have been investigated. Minor but significant differences in composition are found between the amphibolite and granulite facies, as a result of removal of some constituents from the granulite zone. The lower K content of the hornblende granulite facies than of adjacent amphibolite facies suggests that significant fractionation of this heat-producing element occurs during deep-seated regional metamorphism. Differences between average composition of this area and published averages for surface shield rocks probably reflect chemical zoning of the crust resulting from transport of low-temperature constituents to higher crustal levels.—D.B.V.

7515 **Ebens, Richard J.; Smithson, Scott B.** Petrography of Precambrian rocks from a 3,05 kilometer deep borehole, Wind River Mountains, Wyoming: Wyoming Univ. Contr. Geology, v. 5, no. 1, p. 31–38, illus., tables, 1966.

The borehole is located on the west flank of the Precambrian core of the Wind River Mts. Rock types cored range from quartz-dioritic to quartz monzonitic gneiss; the proportions of K-feldspar and plagioclase vary greatly, as do textures. Neither composition nor texture show any systematic relation to depth and retrograde features are found sporadically. Final mineral assemblages attained seem to be largely conditioned by local variation in H_2O concentration. Modal composition diagrams are included.—E.S.L.

Echols, Dorothy Jung. *See* Stinchcomb, Bruce L. 7523

Edwards, Jerry L. *See* Robie, Richard A. 7327

7457 **Eglinton, G.; Scott, P. M.; Belsky, T.; Burlingame, A. L.; Richter, W.; Calvin, M.** Occurrence of isoprenoid alkanes in a Precambrian sediments, *in* Advances in organic geochemistry, 1964: Oxford, England, Pergamon Press (Internat. Ser. Mons. earth Sci., V. 24), p. 41–74, illus., tables, 1966.

Isoprenoid hydrocarbons, including farnesane, pristane, and phytane, are present in the Marker Bed of the Precambrian Nonesuch Shale Formation at the White Pine Mine, Michigan, and in oil seep associated with it. Column chromatography over activated alumina, molecular sieve (5A) treatment, and gas–liquid chromatography provided the isolation procedures for the individual hydrocarbons, which were identified by retention time on gas–liquid chromatography, and by comparison of infrared and mass spectra.—*from* Authors' summary

7588 **Ehmann, William D.; Tanner, James T.** The abundance of antimony in meteorites: Earth and Planetary Sci. Letters, v. 1, no. 5, p. 276–279, illus., tables, 1966.

The abundance of antimony in various classes of meteorites has been determined by neutron activation analysis. A specific radiochemical separation procedure was used to obtain antimony samples of high radiochemical purity. Experimental cosmic abundances of antimony based on several different models have been calculated.—Authors' abstract

7508 **Eichholz, Geoffrey G.; Galli, Ann N.; Elston, Lewis W.** Problems in trace-element analysis in water: Water Resources Research, v. 2, no. 3, p. 561–566, illus., table, 1966.

The work described indicates some of the sources of error that may creep into trace analyses in water. Sampling problems associated with adsorption losses on beaker walls or filter paper may assume serious proportions, although this is less important in hard water. Fractionation of trace elements by selective adsorption or exchange on suspended matter must be assessed in describing the composition of water. It is found that a clearer definition is required for the conventional dissolved solids determinations.—E.S.L.

Eisele, C. R. *See* Fagerstrom, J. A. 7521

7350 **Eitel, Wilhelm.** Silicate science—V. 4, Hydrothermal silicate systems: New York, Academic Press, 617 p., illus., tables, 1966.

Advances in investigations of hydrothermal synthesis have been more revolutionary than in other fields presented in this treatise, and have required a total reorganization of data. An attempt is made to establish a systematic classification of the experimentally studied systems. Section A, silicate systems with volatiles, has three parts: gas absorption in fused silicates; silicate systems with volatile components, covering the role of water in volcanic phenomena, metasomatosis, geothermal significance of gas–liquid inclusions, mineralization, participation of silica and silicates in heterogeneous gas reactions, and high pressure apparatus; and hydrothermal syntheses and equilibria. Section B, dehydration behavior of silicate hydrates, covers the zeolites and related materials. An appendix adds information to the footnotes, and author, subject, compound, and mineral indexes are included.—E.S.L.

7351 **Eitel, Wilhelm.** Silicate science—V. 5, Ceramics and hydraulic binders: New York, Academic Press, 618 p., illus., tables, 1966.

In Section A, the role that reactions in the solid state plays in modern silicate science is discussed. Great progress has been made in development of the theory of structural defects, especially their influence on the mobility of atoms by diffusion. Problems involved in the kinetics of such reactions are not entirely resolved, but the possibility exists of applying radioactive tracer techniques. Section B, reactions in ceramic bodies, not only deals with classical clay ceramic methods, but also reviews studies by Brindley and Nakahira which elucidated the "meta-kaolin" problem and also the nature of the intermediate phases before crystallization of

mullite. Portland cements and related hydraulic binders are covered in Section C. Author, subject, compound, and mineral indexes are included. —E.S.L.

7600 **Eleman, Folke.** The response of magnetic instruments to earthquake waves: Jour. Geomagnetism and Geoelectricity, v. 18, no. 1, p. 43–72, illus., tables, 1966.

The response of standard magnetographs to earthquake waves is a seismograph effect; these instruments react as ultra-low sensitivity seismic recorders. With little or no additional effort some magnetic observatories could be used as supplementary sesmic stations. Effects of the Alaskan earthquake of March 28, 1964, are studied in detail; a number of similar cases are known. Even if the response of standard magnetographs is definitely of a mechanical nature it is likely that the earthquake waves do generate real magnetic waves. Some experimental evidence (from Bergen Park, Colo.) of existence of such waves is presented. It is shown that piezomagnetic oscillations in magnetic rock or induced currents in a region with enhanced conductivity may offer an explanation. These effects are associated with anomalous conditions in the crust. Properties of the "average crust" cannot explain the observed magnetic variations. —*from* Author's abstract

Ellis, A. J. *See* Barnes, H. L. 7340

Elston, Lewis W. *See* Eichholz, Geoffrey G. 7508

7482 **Emerson, David E.; Stroud, Lowell; Meyer, Thomas O.** The isotopic abundance of neon from helium bearing natural gases: Geochim. et Cosmochim. Acta, v. 30, no. 9, p. 847–854, illus., tables, 1966.

The abundance of neon isotopes from seven helium bearing natural gas sources is reported. The results indicate that the amounts of Ne 21 from helium bearing natural gas sources are significantly higher (45 to 500 percent) than those from atmospheric neon, and vary according to the source. Wetherill (1954) has suggested that nuclear reactions such as O 18(a,n)Ne 21 could explain the excess Ne 21. D.B.V.

7561 **Emmons, Walter F.; Urena, Rafael de.** Interstitial pressures on rock foundations of dams—Discussions [of paper 4484 by J. L. Serafim and A. del Campo, 1965]: Am. Soc. Civil Engineers Proc., v. 92, Jour. Soil Mechanics and Found. Div., no. SM 4, p. 94–97, illus., 1966.

Emmons comments on the quantitative evaluation of joint spacing and size in dam foundation rock under varying stress, temperature, grouting, etc., as an approach to a theory of uplift pressures. Urena is interested in the problem of the percolation of reservoir water through the foundations of concrete dams. Any problem can be solved mathematically if the form is simple enough; the art consists in the correct choice of variables that most closely reflect reality. Water load will tend to open joints in the upstream section at the base of the dam, and stress communicated by the structure to the foundation will tend to close the joints in the downstream section because the first reaction of the structure is to rotate. Then the structure will be in a state to fail by sliding. —G.D.C.

7674 **Enbysk, Betty J.; Linger, Fay I.** Mysid statoliths in shelf sediments off northwest North America: Jour. Sed. Petrology, v. 36, no. 3, p. 839–840, illus., 1966.

Sediment containing statoliths, fluoride-rich concretionary particles contained in the statocysts of opossum shrimp, is common on the shelf areas of the northern Pacific Coast. Sediment containing smaller, non-fluoride statoliths is present but less common in deep water. —R.A.C.

7700 **Enlows, Harold E.; Oles, Keith F.** Authigenic silicates in marine Spencer Formation at Corvallis, Oregon: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 9, p. 1918–1926, illus., tables, 1966.

Authigenic pyroxene and amphibole occur in nonmetamorphosed sedimentary rock of the Spencer Formation of late Eocene age at Corvallis, Oreg. Reconstruction of the diagenetic environment indicates a temperature of about 140°F., solutions

somewhat less saline than sea water, a pH of slightly less than 7.0, and an Eh near −0.2.—A.E.R.

Eppley, R. A. *See* Wood, H. O. 7304

7692 **Erdosh, George.** Evaluation of infrared absorption spectroscopy for quantitative analysis of rocks: Canadian Jour. Earth Sci., v. 3, no. 5, p. 733–735, 1966.

Difficulties are discussed and it is concluded that, with techniques available today, infrared absorption spectroscopy does not appear to be a suitable method for the routine modal analysis of rocks.—E.S.L.

7705 **Erickson, Max P.** Igneous complex at Wah Wah Pass, Beaver County, Utah: Utah Geol. and Mineralog. Survey Spec. Studies 17, 14 p., illus., geol. map, 1966.

Three small dioritic stocks here have associated rock alteration features which suggest related economic mineralization. Most significant is the argillic alteration disseminated pyrite in a breccia zone in the easternmost stock. Reconnaissance geochemical analyses revealed no anomalous concentrations of copper, lead, zinc, or molybdenum in the surface exposures. Magnetic readings from 400 to 1,000 gammas above background were obtained over the dioritic stocks; local anomalies range to 9,000 gammas. The anomalies, which do not correlate with observable surface features, are most numerous over the brecciated and altered eastern stock. Further exploration by other geophysical methods, by more intensive geochemical techniques, or by drilling may disclose subsurface economic mineralization.—Author's abstract.

7423 **Etheridge, Richard.** An extinct lizard of the genus *Leiocephalus* from Jamaica: Florida Acad. Sci. Quart. Jour., v. 29, no. 1, p. 47–59, illus., 1966.

Leiocephalus jamaicensis, n. sp., an extinct iguanid lizard, is described from several probably late Pleistocene cave deposits in Jamaica; the holotype is a left dentary from Dairy Cave, west of Dry Harbour, St. Anns Parish. The genus is now confined to the West Indies where it occurs on almost all islands except Jamaica and those south and east of Hispaniola. Extinct species have been described previously from the late Pleistocene of Barbuda and Hispaniola, and from the early Miocene of Florida, indicating that the peculiar specializations of the genus were attained by at least mid Cenozoic, and that its range during late Pleistocene may have included all islands of the West Indies. The genus probably evolved from a South American tropidurine immigrant and spread northward.—V.M.J.

7358 **Evans, Howard T., Jr.; Mrose, Mary E.** Shattuckite and planchéite—A crystal chemical study: Science, v. 154, no. 3748, p. 506–507, illus., table, 1966.

The orthorhombic crystal structures of shattuckite, $Cu_5(SiO_3)_4(OH)_2$, and planchéite, $Cu_8(Si_8O_{11})_2(OH)_4 \cdot H_2O$, have been solved. Shattuckite contains silicate chains similar to pyroxene in a complex association with copper atoms, while the closely related planchéite contains silicate chains similar to amphibole.—Authors' abstract

7626 **Evans, James R.** Nephrite jade in Mariposa County: California Div. Mines and Geology Mineral Inf. Service, v. 19, no. 9, p. 135–147, illus., tables, 1966.

Jade was found in Mariposa County, Calif., in September 1962 and discoveries to date indicate a jade province of about 13 sq mi. The nephrite occurs in lenses associated with serpentine, and in boulders. The Coulterville–Bagby area is described, and a map showing jade locations is included. Methods of mining, and of evaluating and prospecting are discussed. Comparison of the forms of minerals which have been called jade is tabulated, and the properties of nephrite jade are described. A geologic map of the Mandarin Empire deposit is included.—E.S.L.

7402 **Everett, K. R.** Slope movement and related phenomena, Chap. 12 *in* Environment of the Cape Thompson region, Alaska: U.S. Atomic Energy Comm. Rept. PNE-481, p. 175–220, illus., tables, 1966.

The objectives of the study were to determine quantitatively the rate of movement of the material mantling the slopes of Ogotoruk Creek, and to study the relation of soil moisture, temperature, and ice type, to this movement. The area was divided into four geomorphological regions, and 12 movement sites were established, half on each slope. Slope movements during the 1960–61 freeze up and 1961–62 thaw are discussed. Other movements, due to frost action, wind, and running water are described. Movement of material is greater on the steeper, southeast facing slope. An appendix describes ice types.—E.S.L.

Ewing, G. C. *See* Inman, D. L. 7385

7455 **Ewing, G. N.; Hobson, George D.** Marine seismic refraction investigation over the Orpheus gravity anomaly off the east coast of Nova Scotia: Canada Geol. Survey Paper 66–38, 10 p., illus., tables, 1966.

The interpreted results of three refraction profiles across the Orpheus gravity anomaly are presented. To the north of the anomaly axis, depth to crystalline basement is about 1.4 km. Near the axis and to the south, the depth is at least 2 km and probably more than 3, but does not show on the profiles. A multilayered sedimentary rock structure is indicated, but no basement configuration is delineated to account for the negative gravity anomaly. It might be caused by a thick section of low density material deposited in a graben.—E.S.L.

7695 **Ewing, John; Ewing, Maurice; Leyden, Robert.** Seismic profiler survey of Blake Plateau: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 9, p. 1948–1971, illus., tables, 1966.

Continuous seismic reflection profiles on Blake Plateau, correlated with sediment cores, seismic refraction data, and logs of wells on Florida, indicate that the entire Blake–Bahama–Florida area was the site of shallow water carbonate deposition behind a barrier reef until late in the Mesozoic. Death of the reef along the Blake Plateau margin and continued subsidence of the entire area created the present submerged plateau. Florida and the Bahama banks continued to build throughout the Tertiary and have maintained an elevation near sea level. Four strong reflectors are observed in the plateau sediments, the deepest apparently representing an interface within the Upper Cretaceous and correlating with the top of a 4.5 kmps refracting layer. The overlying beds probably are composed of bank-derived calcarenite and calcilutite.—W.C.C.

Ewing, Maurice. *See* Ewing, John. 7695

7521 **Fagerstrom, J. A.; Eisele, C. R.** Morphology and classification of the rugose coral *Pseudozaphrentoides verticillatus* (Barbour) from the Pennsylvanian of Nebraska: Jour. Paleontology, v. 40, no. 3, p. 595–602, illus., 1966.

The previous literature pertaining to *Pseudozaphrentoides verticillatus* (Barbour) is briefly reviewed and the species redescribed and reillustrated on the basis of a large and varied assemblage of topotypic specimens from the Upper Pennsylvanian (Virgil Series) of eastern Nebraska. The assemblage contains specimens of three intergradational morphotypes: (1) solitary, completely unbudded corallites, (2) quasi-colonial protocorallites with randomly distributed buds and offsets, and (3) quasi-colonial protocorallites with buds and offsets arranged in verticils and also randomly distributed between verticils.—Authors' abstract

Fahrig, W. F. *See* Eade, K. E. 7682

7379 **Fair, Gordon Maskew; Geyer, John Charles; Okun, Daniel Alexander.** Groundwater flow, Chap. 9 *in* Water and wastewater engineering—V. 1, Water supply and wastewater removal: New York, John Wiley and Sons, p. 9–1—9–35, illus., 1966.

This chapter evaluates the hydrologic, geologic, and hydraulic properties of groundwater sources and analyzes their influence on ground-water capture for water supply. Factors governing the availability of ground water are difficult to evaluate, but measurable. Available quantitative information is generally meager and

fragmentary. Principles are outlined and diagrammed, and equations given for various conditions.—G.D.C.

7453 **Fairbairn, H. W.; Bottino, M. L.; Pinson, W. H., Jr.; Hurley, P. M.** Whole-rock age and initial $^{87}Sr/^{86}Sr$ of volcanics underlying fossiliferous Lower Cambrian in the Atlantic provinces of Canada: Canadian Jour. Earth Sci., v. 3, no. 4, p. 509–521, illus., tables, 1966.

A Rb–Sr whole rock age study has been carried out on three volcanic groups underlying the Lower Cambrian in the Atlantic provinces of Canada. The contemporaneity of the Coldbrook, Fourchu, and Bull Arm Groups, predicted on field evidence, is confirmed, as is the greater age of the Harbour Main Group, unconformably underlying younger formations, including the Bull Arm. However the isochron ages (500 m.y. average) are at least 10 percent low for the base of the Cambrian. It is suggested that small diffusion of Rb into the rocks has occurred. The initial ratio of Sr 87 to Sr 86 suggests a subsialic source for the magmas.—E.S.L.

Farb, Peter. *See* Hay, John. 7393

Farnham, R. S. *See* Holowaychuk, N. 7403

7631 **Fassett, James E.** Geologic map of the Mesa Portales quadrangle, Sandoval County, New Mexico: U.S. Geol. Survey Geol. Quad. Map GQ–590, scale 1:24,000, section, text, 1966.

None of the wells drilled in the Mesa Portales quadrangle produced oil or gas in commercial quantity, but because of production in Entrada and Gallup Sandstones less than one mile to the southwest, possibilities exist. Coal crops out in the southern part of the map area in the undivided Kirtland Shale and Fruitland Formation, and occurs also in the upper and lower parts of the Menefee Formation.—M.C.M.

7277 **Fechtig, H.; Kalbitzer, S.** The diffusion of argon in potassium-bearing solids, *in* Potassium argon dating: New York, Springer-Verlag, p. 68–107, illus., tables, 1966.

The diffusion of argon in solids became important because the K–Ar dating of certain minerals gave lower values than the geologic methods. The fundamental laws of diffusion, the boundary conditions, and practical mathematical forms are reviewed. Complications produced by irregular shape, a variety of grain sizes, or complex composition, are described, and correction of ages discussed. The discussion of experimental methods of diffusion measurements is divided into mass spectrometry, neutron activation, and isothermal and linear heating. Experimental results on synthetic single crystals, minerals (mostly mica and feldspar), polycrystalline systems such as meteorites, and glasses, comprise the largest section. The thermal history of minerals and other possible influences on K–Ar ages conclude the paper.—E.S.L.

7601 **Fenton, Thomas Eugene.** Soils, weathering zones, and landscapes in the upland loess of Tama and Grundy Counties, Iowa [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, p. 21B–22B, 1966.

7500 **Fenwick, K. G.** Snakeweed Lake area (Fredart–Whitemud Lakes area), Patricia portion, District of Kenora: Ontario Dept. Mines Prelim. Geol. Map P.349, scale 1 in. to 1/4 mi., text, 1966.

There are three ENE trending metavolcanic–metasedimentary belts in the Fredart–Whitemud Lakes area which are separated by granitic and dioritic rocks. Metasediments, in the central and southeastern belts, consist of impure quartzite, graywacke, slate, and arkose. Metavolcanics are massive to sheared greenstone and are intercalated with thin belts of tuffs, basic sediments, and banded iron-formation. Both metasediments and metavolcanics are intruded by diorite and gabbro dikes, sills and irregular masses. No major faulting was recognized. Two surface showings of sulfide mineralization occur in a coarse amphibolite and consist of nearly massive pyrrhotite–pyrite, often with considerable magnetite. Drilling of four anomalies has

been encouraging but continuity of sulfide mineralization has yet to be outlined.—M.C.M.

7501 **Fenwick, K. G.** Belanger township (Fredart Whitemud Lakes area), Patricia portion, District of Kenora: Ontario Dept. Mines Prelim. Geol. Map P.350, scale 1 in. to 1/4 mi., text, 1966.

The text for the Fredart Whitemud Lakes area is abstracted for Map P.349 (Fenwick, 1966).—M.C.M.

7502 **Fenwick, K. G.** Bowerman township (west part) (Fredart Whitemud Lakes area), Patricia portion, District of Kenora: Ontario Dept. Mines Prelim. Geol. Map P.351, scale 1 in. to 1/4 mi., text, 1966.

The text for the Fredart Whitemud Lakes area is abstracted for Map P.349 (Fenwick, 1966).—M.C.M.

Feray, Dan E. *See* Oetking, Philip. 7302

7408 **Ferguson, S. A.; Brown, D. D.** (compilers). Red Lake sheet, District of Kenora: Ontario Dept. Mines Prelim. Geol. Map P.355, scale 1 in. to 2 mi., 1966.

7412 **Ferguson, S. A.** (compiler). Red Lake area, District of Kenora: Ontario Dept. Mines Prelim. Geol. Map P.338, scale 1 in. to 1 mi., 1966.

7513 **Ferris, Clinton S., Jr.** Structural analysis of the Precambrian rocks southeast of Encampment, Wyoming: Wyoming Univ. Contr. Geology, v. 5, no. 1, p. 13–19, illus., 1966.

This structural analysis is based on study of 1,100 foliation attitudes from an area of about 20 sq mi on the lower north flank of the Sierra Madre Mts., Wyo. Equal-area projections of foliation attitudes, with field observations, suggest that the structure of the gneiss in the north is a northerly plunging synform, antedating intrusion by amphibolite. The synform has been transposed, in part, by penetrative action. Pi diagrams and maps are included.—E.S.L.

Field, C. W. *See* Peters, W. C. 7528

Finney, H. R. *See* Holowaychuk, N. 7403

7231 **Finney, J. J.** Refinement of the crystal structure of euchroite, $Cu_2(AsO_4)(OH)\cdot 3H_2O$: Acta Cryst., v. 21, pt. 3, p. 437–440, illus., tables, 1966.

The structure of euchroite, as determined by Giuseppetti (1963), using 3-dimensional Patterson sections to determine the heavy atom positions, was completed by means of electron density projections. As part of an overall study of the crystal chemistry of secondary copper minerals a 3-dimensional refinement of this structure was considered necessary to portray the structure more accurately and to describe the complex hydrogen bonding which occurs in euchroite. Positional parameters and temperature factors, and interatomic distances and angles for euchroite are tabulated. Euchroite represents, not only compositionally but structurally as well, a hydrated olivinite.—G.D.C.

7668 **Fisher, Richard V.** Textural comparison of John Day volcanic siltstone with loess and volcanic ash: Jour. Sed. Petrology, v. 36, no. 3, p. 706–718, illus., 1966.

Fields of correlation points were constructed by graphically correlating phi median grain sizes and sorting coefficients of sediments forming the volcanic siltstones. Comparison of the constructed fields with those of typical loess and ash formations suggests that textures of the siltstones of the middle Oligocene–lower Miocene John Day Formation in eastern Oregon are more characteristic of ash then of loess. Physical resemblance of the siltstones to massive loess deposits is due partly to the continuous homogenizing action of burrowing animals, root wedging, and frost heaving which destroy what otherwise might be sharp contrasts in texture and in bedding structures within the John Day siltstones.—R.A.C.

7259 **Flock, D. L.; McIlhargey, J. M.** Some aspects of gas field mathematical models [abs.]: Oilweek, v. 17, no. 30, p. 33, 1966.

Flores, Armando. *See* Bustamante, Jorge I. 7571

7599 **Florida Division of Water Resources.** Florida land and water resources—Southwest Florida: Tallahassee, Fla., Florida Board Conserv., 181 p., illus., tables, 1966.

The area of this report covers about 10,000 sq mi in southwestern Florida, the eastern boundary coinciding with surface and ground-water divides. Section 1 is principally a description of the Floridan aquifer of Eocene-Miocene age, but also includes a summary of the general geology and topography of the area. Climate is discussed in section 2, and section 3, prepared by the Water Resources Division, U.S. Geological Survey, describes the general hydrology of the area, and presents information on rainfall, surface and ground water discharge, and chemical quality of the water. Floridan aquifer formations are tabulated with their water-bearing characteristics. Four sections deal with water utilization. Conclusions and recommendations are given in section 8, and the last section is a bibliography.—E.S.L.

7395 **Folsom, Franklin.** Science and the secret of man's past: Irvington-on-Hudson, N. Y., Harvey House, 192 p., illus., 1966.

This elementary introduction to man's past, written in a popular vein, includes historical sketches of scientists and others who recognized clues to ancient life and culture; and chapters on the discovery of the ice ages, a calendar in clay, ancient pollen, tree rings, fossil magnetism and fossil time, C 14 dating, isotopes, and foraminifera in sedimentary cores.—G.D.C.

Fort, A. Newman, Jr. *See* Bradley, James J. 7330

7607 **Foutz, Dell Riggs.** Stratigraphy of the Mississippian system in northeastern Utah and adjacent states [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, p. 208B-209B, 1966.

Fowells, J. E. *See* Simmons, W. W. 7567

7661 **Fraser, A. G.** Patchy zoning in plagioclase—A discussion [of paper by J. A. Vance, 1965]: Jour. Geology, v. 74, no. 4, p. 514-517, 1966.

The bytownite of the olivine and hypersthene gabbros of the Antarctic Peninsula shows patchy zoning consisting of small uniformly oriented blocks of andesine labradorite, both in the cores and in the rims of the host crystals. In this respect the plagioclase differs from that in the Cascade Mountains of Washington (described by Vance, ibid., v. 73, p. 636, 1965), and a different mechanism is suggested, involving unmixing of a more sodic phase from a more calcic host and then enlargement by replacement. (Vance, ibid., v. 74, p. 518).—R.E.W.

7487 **Freeberg, Jacquelyn H.** Terrestrial impact structures—A bibliography: U.S. Geol. Survey Bull. 1220, 91 p., illus., 1966.

This bibliography lists 110 features for which origin by meteoritic impact has been suggested and gives a comprehensive group of references for each feature. Annotations for the more significant contributions to the literature are included. The structures are divided into six categories, and their geographic locations are indicated on a sketch map.—Author's abstract

7461 **Freers, Theodore F.** Significance of structural features of the Vaughan Lewis Glacier, Alaska: North Dakota Acad. Sci. Proc. 1965, v. 19, p. 224-228, illus., 1966.

The Vaughan Lewis Glacier is a valley glacier flowing from the Juneau Icefield, the structural features of which reveal the types of flow and stresses at the surface. Three principal types of structures were examined: crevasses, icefolds, and bands; each is described. Large transverse crevasses in the névé area indicate extending

flow. The highly transverse-crevassed upper two-thirds of the icefall indicates a longitudinal principal tension or extending flow, and in the lower third, icefolds and splaying crevasses reveal transverse principal tension or compressive longitudinal flow. In the ablation zone, the crevasse patterns and shapes of the bands suggest continuous longitudinal compressive flow. Transverse crevasses in the terminal area indicate extending flow.—E.S.L.

Friedrich, G. *See* Boyle, R. W. 7589

7697 **Frost, S. H.; Langenheim, R. L., Jr.** Paleontology of the *Stringocephalus* biostrome, Piute Formation (Middle Devonian), Arrow Canyon Range, Clark County, Nevada: Jour. Paleontology, v. 40, no. 4, p. 911–930, illus., 1966.

Acid reduction of 300 pounds of selected silicified material from the prominent *Stringocephalus* biostrome in the Piute Formation has yielded: *Actinostroma sp., Idiostroma sp., Thamnopora limitaris, Temnophllum waltheri n. sp., Gypidula (Gypidula) sp., Stringocephalus nevadensis n. sp., Rensselandia cloudi n. sp., Rensselandia sp., Spinatrypa cf. S. aspera, Ladjia cordillera n. sp.* Satisfactory ecologic interpretation of the *Stringocephalus* biostrome must explain the extremely wide distribution of similar features in eastern Nevada and western Utah, restriction of such deposits to a narrow stratigraphic range, the great abundance of individuals of very few species, etc. Apparently the biostrome resulted from preservation of a short lived, ecologically restricted assemblage in a clinoform deposit.—*from* Authors' abstract

Frye, John C. *See* Willman, H. B. 7383

7294 **Fullerton, Donald S.** Mineral resources summary of the Watertown quadrangle, Tennessee: Nashville, Tennessee Div. Geology, 4 p., 1966.

The accompanying text to Tennessee Div. Geology Geol. Map GM 318-SW by C. W. Wilson, Jr. and R. A. Miller (cited separately) describes the limestone resources of the Watertown quadrangle. The Carters and Bigby-Cannon Limestones contain the most desirable stone for general-purpose and agricultural uses. M.C.M.

7299 **Fullerton, Donald S.** Mineral resources summary of the Alexandria quadrangle, Tennessee: Nashville, Tennessee Div. Geology, 4 p., 1966.

The limestone resources of the Alexandria quadrangle are described in this text accompanying Tennessee Div. Geology Geol. Map GM 318-SE by R. H. Barnes and C. W. Wilson, Jr. (cited separately). The Carters and Bigby-Cannon Formations contain the most desirable stone for general-purpose and agricultural limestone; all quarries are in the Carters which is widely exposed.—M.C.M.

Fullerton, Donald S. *See* Swingle, George D. 7637

Fullerton, Donald S. *See* Miller, Robert A. 7638

Fullerton, Donald S. *See* Miller, Robert A. 7639

Fullerton, Donald S. *See* Swingle, George D. 7640

Fyfe, W. S. *See* Burns, R. G. 7653

7266 **Galbreath, Edwin C.** A record of *Democricetodon* (Order Rodentia) from the late Tertiary of northeastern Colorado: Illinois Acad. Sci. Trans., v. 59, no. 3, p. 212–213, illus., table, 1966.

Democricetodon (D.) sp. is reported from latest Miocene or earliest Pliocene deposits in Weld County, Colo.—Author's abstract

7249 **Galeski, R. B.** Recent use of the gravitimeter [sic] in mining exploration [abs.]: Oilweek, v. 17, no. 30, p. 34, 1966.

Galli, Ann N. *See* Eichholz, Geoffrey G. 7508

7366 **Gardiner, Brian George.** Catalogue of Canadian fossil fishes: Toronto Univ. Royal Ontario Mus. Life Sci. Contr. 68, 154 p., 1966.

The Royal Ontario Museum's fish cataloging project grew from the cataloging of fish localities within the Province of Alberta to its present form, in which all fossil fish recorded from Canadian localities are cited. A full synonomy has been attempted for each species, and as far as possible all references to that species have been incorporated. The entries are arranged systematically.—E.S.L.

Garman, R. Keith. *See* Swingle, George D. 7637

Garman, R. Keith. *See* Miller, Robert A. 7638

7456 **Gatewood, Lloyd E.** Some aspects of the geologic history of Cleveland, McClain, and Oklahoma Counties, Oklahoma: Shale Shaker, v. 16, no. 10, p. 227–244, illus., 1966.

Criner Payne oil field provides a complete history of the area, and most of the report is based on it and includes isopach and structure maps, and cross sections. The field has a faulted, elongate structure that continued to grow and tilt from Ordovician through Pennsylvanian time. Data on the Hunton and Bromide reservoirs are given. The most prolific production in this three-county area is from low relief structural traps in the Simpson sands, which furnish other examples of structural growth and axial shifting. Plotting of a growth bar graph or growth curve, from isopach maps and cross sections is suggested as a way of dating producing structures. The Arbuckle Group could start a new era in oil exploration in view of the structural history of the area.—E.S.L.

Gersper, P. L. *See* Holowaychuk, N. 7403

Geyer, John Charles. *See* Fair, Gordon Maskew, 7379

7503 **Giblin, P. E.** Township 27, Range 13, District of Algoma: Ontario Dept. Mines Prelim. Geol. Map P.359, scale 1 in. to 1/4 mi., text, 1966.

Archean basic metavolcanics, minor intercalated acid metavolcanics, and iron formation comprise the oldest rocks within the township; they have been intruded successively by Archean granite, Lower Keweenawan diabase dikes, and Middle Keweenawan felsite dikes. A breccia zone, about 2,000 feet by 1,000 feet, straddles the west border and contains chalcopyrite, pyrite, and molybdenite. Three directions of faulting are present: northwesterly (most common), northeasterly, and northerly.—M.C.M.

7458 **Given, P. H.; Binder, C. R.** The use of electron spin resonance for studying the history of certain organic sediments, *in* Advances in organic geochemistry, 1964: Oxford, England, Pergamon Press (Internat. Ser. Mons. Earth Sci., V. 24), p. 147–164, illus., tables, 1966.

The principle of electron spin resonance, and the possibility of using it as a geothermal indicator for carbon, introduce this paper. Pyrolysis experiments were done on both macerals and thermally altered coals, and e.s.r. measurements made. The results are tabulated and shown on graphs, and the possible temperature gradient of the metamorphosed coal discussed. Some conclusions as to the origin of fusinite macerals are considered.—E.S.L.

Glass, H. D. *See* Willman, H. B. 7383

7581 **Glawe, Lloyd Neil.** *Pecten perplanus* stock (Oligocene) of southeastern United States [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, p. 209B, 1966.

7236 **Godard, J. D.** Geology of the Watt Lake area (west half), Granville Lake Mining Division: Manitoba Dept. Mines and Nat. Resources Mines Br. Pub. 61-4, 27 p., table, geol. map, 1966.

The Precambrian stratigraphy and petrology are discussed, and the structural geology and metamorphism described briefly. No economic mineral deposits have yet been found within the map-area, but exploration has been very limited.—E.S.L.

7239 **Godard, J. D.** Geology of the Hambone Lake area, Cross Lake Mining Division, Manitoba: Manitoba Dept. Mines and Nat. Resources Mines Br. Pub. 63-1, 44 p., illus., tables, geol. map, 1966.

The petrology of the Precambrian metamorphic and intrusive rocks is discussed in detail, including the genesis of specific types, with ternary diagrams and tables. Structural geology is reviewed briefly, and a resumé of the economic geology of the nickel deposits is included.—E.S.L.

7656 **Goddard, Edwin N.** Geologic map and sections of the Zuni Mountains fluorspar district, Valencia County, New Mexico: U.S. Geol. Survey Misc. Geol. Inv. Map I-454, scale 1:31,680, separate text, 1966.

Fluorspar occurs in Precambrian rocks forming the core of the Zuni Mountains. Significant features of the deposits are the almost complete lack of sulfide minerals in the veins and the structural control exercised by northwest trending faults. Each of the three groups of veins is in an area of strong faulting, and nearly all production has come from veins close to or intersecting one or more of the northwesterly faults. Gneissic granite seems to be the most favorable host rock, although a few veins occur in other rock types.—M.C.M.

7247 **Godfrey, L. M., Jr.; Schweiger, F.; Stewart, D.** Application of Dinoseis in Canada [abs.]: Oilweek, v. 17, no. 30, p. 42, 1966.

7445 **Goetzmann, William H.** Exploration and empire—The explorer and the scientist in the winning of the American West: New York, Alfred A. Knopf, 656 p., illus., 1966.

The book covers exploration in the American West from the early discoveries of trappers and traders to the formal expeditions of scientific, military, and government men. It begins with the return of Lewis and Clark and ends with the retirement of John Wesley Powell from the U.S. Geological Survey. The 16 chapters are divided into three sections: exploration and imperialism, 1805-45; the great reconnaissance and manifest destiny, 1845-60; and exploration and the great surveys, 1860-1900. A portfolio accompanying each section contains appropriate photographs.—E.S.L.

7619 **Golik, Abraham.** Foraminiferal ecology and Holocene history, Gulf of Panama [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, p. 246B, 1966.

7575 **Gonzalez, Grover.** Subsurface geology of Strawn Pennsylvanian Series, northwest quarter of Wise County, Texas [abs.]: Houston Geol. Soc. Bull., v. 8, no. 8, p. 18, 1966.

7717 **Goodacre, A. K.; Nyland, E.** Underwater gravity measurements in the Gulf of St. Lawrence, *in* Continental drift: Royal Soc. Canada Spec. Pub. 9, p. 114-128, illus., 1966.

In this first major underwater gravimeter work of the Dominion Observatory, measurements show that the crust under the Gulf is continental in character, nearly isostatic in equilibrium, and undergoes a change in the Gaspé Peninsula area. The Gaspé high, North Point low, and Kingston high indicate extensions of early or middle Paleozoic basement features under the Gulf, while the Magdalen low and anomalies between Prince Edward and Cape Breton Islands appear to be produced by variations within the late Paleozoic sedimentary column. The Gaspé high outlines a continuation of a major structure from the Gaspé Peninsula towards Newfoundland and tends to resolve the problem of structural discontinuities between Newfoundland and the mainland. Further seismic information is needed and more detailed gravity coverage desirable.—G.D.C.

7524 **Gordon, Mackenzie, Jr.** New spinose early Meramec (Upper Mississippian) productoid brachiopods: Jour. Paleontology, v. 40, no. 3, p. 573-584, illus., 1966.

The new genus *Scoloconcha* (type, *Productus indianensis* Hall) is from the Salem Limestone of Indiana. The new genus *Platyselma* (type, *P. echinatum*, n. sp., from Oklahoma) contains the new species *P. simplex* (Missouri and Kentucky) and *P. quapawense* (Oklahoma). The new genus *Crossacanthia* (type, *C. perlamellosa* from Missouri and Kentucky) contains the new species *C. macknighti* from Oklahoma.—R.E.G.

7646 **Grant, A. C.** A continuous seismic profile on the continental shelf off NE. Labrador: Canadian Jour. Earth Sci., v. 3, no. 5, p. 725–730, illus., 1966.

The total length of a sparker survey off northeastern Labrador was about 28 km. Bottom and sub bottom reflections, plotted as a cross section, show a marginal channel which parallels the coast line and is similar to those described on the continental shelves of Norway, Greenland, Antarctica, and other areas. These channels have been explained by some as due to faulting and by others as due to erosion. This particular channel has been traced over 400 km southeast from the latitude of the seismic profile and no indications of a fault have been found. Speculations are made about the nature of the inner and outer shelves, which this channel separates.—E.S.L.

7441 **Green, L. H.** The mineral industry of Yukon Territory and southwestern District of Mackenzie, 1965: Canada Geol. Survey Paper 66-31, 137 p., tables, 1966.

This is the sixth of an annual series of papers on mineral industries. Brief descriptions of most active lode and placer properties in the Yukon are given, and some inactive lodes are included so that a record will be available, and the Nahanni tungsten orebody, Mackenzie, is included. In 1965, the estimated value of mineral production in the Yukon was 13,341,266 dollars, most of which was silver, lead, and zinc.—E.S.L.

Greene, G. W. *See* Lachenbruch, A. H. 7400

7533 **Greenman, E. F.** Chronology of sites at Killarney, Canada: Am. Antiquity, v. 31, no. 4, p. 540–551, illus., 1966.

Near Killarney [Ontario], Canada, three raised beaches of former Great Lakes stages have cultural material in circumstances indicating contemporaneity with the construction of the beaches 7000 B.C. and A.D. 1. The physical conditions demonstrating this contemporaneity are set forth in detail, with illustrations of artifacts in situ in gravels. The several components of two sites are distinguished, and a workshop with most of the artifacts in unfinished condition is described and illustrated. The geology, which involves Postglacial uplift of the Lake Huron basin along with rising and lowering levels, is fully outlined.—Author's abstract

7339 **Greenwood, H. J.; Barnes, H. L.** Binary mixtures of volatile components, Sec. 17 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 385–400, tables, 1966.

Data for binary mixtures of volatiles are rather scanty, at least for systems of geological interest, and are of widely differing accuracies. A number of tables present phase data for H_2O–CO_2, H_2O–Argon, H_2S–H_2O, and H_2S–CO_2 components, each with appropriate comments so that uncertainties in the entries may be evaluated. Most of the data have been taken from published work; in regions of overlap the better of two sets has been quoted, rather than an average value. The data on this type of system fall into two groups. Only the supercritical one-phase regions are considered here; the two-phase regions presented are all of the liquid-vapor type.—G.D.C.

Griffin, Margaret S. *See* Weld, Betsy A. 7481

7608 **Grill, Edwin Vatro.** A model for the biogeochemical cycle of silica in the sea [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, p. 209B, 1966.

7582 **Guilday, John E.; Hamilton, Harold W.; McCrady, Allen D.** The bone breccia of Bootlegger Sink, York County, Pa.: Carnegie Mus. Annals, v. 38, art. 8, p. 145–163, illus., table, 1966.

Bootlegger Sink, in Cambrian dolomite, contains a breccia ledge, remnant of a surface-derived talus 1.2 m above present talus. The breccia is composed of dolomite blocks, sandstone pebbles, wood charcoal, unconsolidated loam, and bones of mammals with some amphibians and reptiles, all cemented with travertine. Radiocarbon date on the charcoal is 3,722±200 yr b.p., a minimum date for brecciation. Fluorine analyses of 17 vertebrate species, from 0.88 to 1.93 percent, are positively correlated with age. These values and the known ages of related faunas indicate continuous deposition of the Bootlegger Sink local fauna from late glacial time, about 8000 B.C., to time of brecciation. Of 37 mammal species, 13 are probably of late glacial age, one Hypsithermal, 9 sub-Recent; the remaining 14 could be of any of these ages.—V.M.J.

Gurnee, Russell H. *See* Sloane, Howard N. 7532

7446 **Halstead, E. C.** Surficial geology of Duncan and Shawnigan map areas, British Columbia: Canada Geol. Survey Paper 65-24, 3 p., geol. maps, 1966.

The last major ice sheet moved south to southeast across the map areas, and during deglaciation split into a network of glaciers flowing down the valleys to the sea. Surficial deposits are commonly below an elevation of 500 feet, and include laminated silts and clays, gravels, and stony till. Organic material from near Skutz Falls yielded a radiocarbon date of 21,000±270 yrs, and material from Cowichan Bay 24,560±800 yrs.—Author's abstract

Hamilton, Harold W. *See* Guilday, John E. 7582

7433 **Hamke, J. R.; Marchant, L. C.; Cupps, C. Q.** Oilfields in the Williston basin in Montana, North Dakota, and South Dakota: U.S. Bur. Mines Bull. 629, 487 p., illus., tables, 1966.

Less than 10 years after the first commercial oil discovery in North Dakota in 1951, the petroleum industry became one of the largest industries in this three-state area. Crude petroleum is now its most valuable mineral resource. In 1960, the basin produced 39 million bbl of oil worth 100 million dollars at the wellhead. Most of the pools are in Paleozoic carbonates at depths ranging from 3,000 to 13,000 feet. The major producing fields, on the Cedar Creek anticline in Montana and the Nesson anticline in North Dakota, produce from depths below 6,000 feet. This report presents all phases of the Williston basin petroleum industry, including exploration and geology. Engineering, physical, and production data, maps, and petroleum analyses for 137 separate oil pools are included. —*from* Authors' abstract

7333 **Handin, John.** Strength and ductility, Sec. 11 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 223–289, illus., tables, 1966.

Field geology provides a wealth of evidence relating to kinematics of rock deformation; however, the origin of tectonic forces is conjectural, the state of stress in the crust can seldom be determined quantitatively, and processes of slow deformation are not subject to direct observation in nature. The dynamics must be learned through controlled experiments which reasonably simulate the natural environmental conditions; results of such experiments are outlined. Tables are presented for gliding systems in crystals, for various compressive tests on rocks to show shear strength, transient flow, and creep data. The measurements of different investigators are consistent, and all specimens within each of a few categories are found to behave similarly. An understanding of the influence of time is beginning to evolve.—G.D.C.

7252 **Hannon, N. M.** Hydrodynamics in exploration [abs.]: Oilweek, v. 17, no. 30, p. 36, 1966.

7353 **Hansen, Arnold J., Jr.** Availability of ground water in the Kentucky parts of the Joppa and Metropolis quadrangles, Jackson Purchase region, Kentucky: U.S. Geol. Survey Hydrol. Inv. Atlas HA-171, scale 1:24,000, sections, text, 1966.

The principal aquifer in the Joppa and Metropolis quadrangles is Pliocene(?) and Pleistocene gravel; below the 330 ft water-level contour, the saturated thickness ranges from 3-61 feet. Quality of water is satisfactory for most uses; generally the water is moderately hard and contains about 120-300 ppm of dissolved solids. There is adequate ground water for domestic and industrial use.—M.C.M.

7550 **Hansen, John.** På spor af sjaeldne mineraler i Sydgrønland—[Pt.] 6, Niobium—Et vaerdifuldt metal [with English abs.]: Grønland 1966, no. 9, p. 306-312, illus., table, 1966.

The Ilímaussaq intrusion is predominantly agpaitic nepheline syenites such as naujaite, kakortokite and lujavrite. A niobium mineralization is associated with the formation of the lujavrite and late hydrothermal veins. The most important niobium minerals are pyrochlore and minerals of the epistolite-murmanite group, but several others have been found in the complex. Murmanite is found in pre-agpaitic rocks in which deformation has taken place. Niobium is believed to have been given off from the lujavrite magma. Pyrochlore and epistolite are found mostly in late hydrothermal veins dominantly consisting of albite, analcime, natrolite, and ussingite. The same veins may contain beryllium minerals.—*from* Author's English abstract

7596 **Hansen, W. C.** Concrete aggregates—Chemical reactions, *in* Significance of tests and properties of concrete and concrete-making materials: Am. Soc. Testing and Materials Spec. Tech. Pub. 169-A, p. 487-496, revised 1966; originally published 1956.

Four test methods are used in evaluating aggregate: C 227 or potential alkali reactivity (Mortar Bar Method), C 289 or potential reactivity (Chemical Method), C 295 or recommended practice for petrographic examination, and C 342 or potential volume change. There are three types of reactions that can cause expansion in concrete: solid-water vapor, solid-liquid, and those which give rise to hydraulic pressure. The following reactive components are discussed and their reactions described: oxides of Ca, Mg, Si, Fe; iron sulfides; glasses; gypsum; zeolites; clays; and dolomitic limestones. There appears to be a need for standard test methods to evaluate the aggregate when it undergoes alkali-carbonate reaction.—E.S.L.

Hardeman, William D. *See* Swingle, George D. 7637

Hardeman, William D. *See* Miller, Robert A. 7638

Hardeman, William D. *See* Miller, Robert A. 7639

Hardeman, William D. *See* Swingle, George D. 7640

7409 **Harris, F. R.** Saganagons Lake area, District of Thunder Bay: Ontario Dept. Mines Prelim. Geol. Map P.331, scale 1 in. to 1/2 mi., text, 1966.

Precambrian bedrock in the Saganagons Lake area is generally well exposed but Pleistocene sand and silt cover much of it north and west of Plummes Lake. Oldest units are two belts of metavolcanics separated by massive granite. All primary volcanic structures and foliations in the metavolcanic belt strike ENE and are vertical or steeply dipping. A fault along the north shore of Saganaga Lake has a breccia zone up to 700 feet wide which frequently contains pyrite and small amounts of pyrrhotite and chalcopyrite. A gold quartz vein in this area yielded 0.01 ounces of gold per ton. The best showing of copper mineralization is on the northwest shore of Home Lake; a chip sample contained 1.24 percent copper and a trace of nickel. North of Saganagons Lake an iron formation is 25 feet wide and has an exposed strike length of 500 feet; a chip sample contained 28.4 percent iron. M.C.M.

7476 **Hart, Earl W.** Shell deposits of southern San Francisco Bay: California Div. Mines and Geology Mineral Inf. Service, v. 19, no. 3, p. 41–45, illus., tables, 1966.

Late Quaternary oyster shell deposits, exposed over a large portion of southern San Francisco Bay, are used for cement, livestock food, and soil conditioning. Little effort has been made to explore the deposits by drilling or sampling. The shells tend to accumulate in lenses in soft mud on shallow protected shelves. There are also relatively pure shell beaches and banks exposed in tidal areas. It is estimated that about 30 million tons of shells have been dredged from the bay.—E.S.L.

Hartwig, A. E. *See* Laudon, Lowell R. 7699

7437 **Hashimoto, Seiji; Shimizu, Hiromu; Nakamura, Koji.** Glaciological studies of the Antler Glacier, Alaska: Hokkaido Univ. Fac. Sci. Jour., ser. 4, v. 13, no. 3, p. 237–256, illus., tables, 1966.

Ogives are particularly well developed on Antler Glacier, an arm of Gilkey Glacier in the Juneau Icefield, Alaska, from the base of the ice fall down to the middle part. Dirt bands on the ogives are developed on crests of wavy ice surfaces in contrast to the general concept that bands should be found in troughs; this is a result of well-developed schistosities formed on the front of ice steps by internal stresses which have made the surface rough enough to trap dirt on crests. Nye's mechanism of wave formation in ice at the foot of an ice fall, and surface structures produced by internal, periodic stress of seasonal velocity changes are causes of ogive pattern formation. Varying positions of a moraine suggest a reduction in size and change in flow mode of Antler in response to thinning of Gilkey Glacier in the past 20 years.—V.S.N.

7393 **Hay, John; Farb, Peter.** The Atlantic shore—Human and natural history from Long Island to Labrador: New York and London, Harper and Row, Publishers, 246 p., illus., 1966.

The major emphasis of the book is on the forms of life as they are related to the various environments of the Atlantic shore from Long Island to Labrador. One chapter summarizes the geomorphic features and structure of the land, and of its submarine extensions.—G.D.C.

7534 **Haynes, C. Vance, Jr.; Doberenz, A. R.; Allen, Jack A.** Geological and geochemical evidence concerning the antiquity of bone tools from Tule Springs, Site 2, Clark County, Nevada: Am. Antiquity, v. 31, no. 4, p. 517–521, illus., table, 1966.

Two bone objects from the Tule Springs site, possibly tools, occurred in ancient sedimentary fill of a small spring outlet-channel remnant. The ancient spring was active more than 40,000 years ago and again 12,000 to 13,000 years ago. The fill and the bone contained therein could be of either age. Chemical and X ray analysis on bone of the known ages and bone from the fill showed no significant or systematic differences in fluorine, uranium, nitrogen, or phosphate content. On geological grounds, it is concluded that the bone objects are 12,000 to 13,000 years old. Authors' abstract

7253 **Headlee, A. J. W.** Migration trails of natural gas in eastern North America [abs.]: Oilweek, v. 17, no. 30, p. 36, 38, 1966.

Heck, N. H. *See* Wood, H. O. 7304

Heier, Knut S. *See* Clark, Sydney P., Jr. 7346

7464 **Helgesen, John O.; Karner, Frank R.** Zircon variation in the Tunk Lake granite, southeastern Maine: North Dakota Acad. Sci. Proc. 1965, v. 19, p. 204–212, illus., table, 1966.

Abundance, size, and shape of accessory zircon vary throughout this concentrically zoned intrusion. Zircon populations appear to be systematically related—in the outer part, more abundant, larger, more elongated, and crystallographically less

complex than in the central rocks, with intermediate characteristics between. The prevalent concept that zircon generally does not vary in nature and abundance within a single intrusion is questioned and qualified by this study. Possible causes for the variation are multiple intrusion, regular change of the environment of crystallization of zircon, and separation of an originally homogeneous population by gravity settling.—*from* Authors' abstract

Helgeson, H. C. *See* Barnes, H. L. 7340

7632 **Henderson, John R., Jr.; Stromquist, Arvid A.; Jespersen, Anna.** Aeromagnetic map of parts of the Mother Lode gold and Sierra Foothills copper mining districts, California, and its geologic interpretation: U.S. Geol. Survey Geophys. Inv. Map GP 561, scale 1:62,500, 1966.

Hennion, J. *See* Sheridan, R. E. 7694

Henoch, W. E. S. *See* Coleman, A. 7381

Henry, Vernon J., Jr. *See* Howard, James D. 7675

Hersey, J. B. *See* Bunce, Elizabeth T. 7386

7687 **Hershey, Robert E.; McCary, Charles E. L.** Mineral resources summary of the Milky Way quadrangle, Tennessee: Nashville, Tennessee Div. Geology, 7 p., 1966.

The map accompanying this text (Tennessee Div. Geology Geol. Map GM 58-SE) by C. W. Wilson, Jr., C. E. L. McCary, and R. H. Barnes is cited separately. In the Milky Way quadrangle the Carters Limestone is most desirable for general purposes; the Bigby Cannon and Lebanon Limestones are suitable for some purposes. All mines and known deposits of brown phosphate are within the distribution belt of the Bigby Cannon.' Residual material from the Fort Payne Formation is the source of chert for road materials. A limited amount of gravel is present along flood plains of creeks.—M.C.M.

7404 **Heusser, Calvin J.** Palynology of the Ogotoruk Creek area, Chap. 15 *in* Environment of the Cape Thompson region, Alaska: U.S. Atomic Energy Comm. Rept. PNE-481, p. 355-362, illus., table, 1966.

Pollen diagrams of the peats and associated sediments from the vicinity of Ogotoruk Creek are discussed in terms of the postglacial vegetational history at Cape Thompson and in relation to pollen diagrams from other places in arctic Alaska. The relative dominance of the more important plant species, genera, and families was scaled from phytosociological data to gain insight into the relation between pollen spectra in the diagrams and proportions of plants from which pollen was derived. Profiles for *Betula*, Cyperaceae, *Salix*, and Gramineae were the most prominent. Although internal consistency was apparent, varying degrees of truncation were manifest from section to section.—Author's abstract

7572 **Heystek, Henry.** Glass sand, refractory grain, and beneficiated kaolin produced at Ione, Calif. [abs.]: Mining Eng., v. 18, no. 8, p. 33, 1966.

Hicks, Carol L. *See* Titley, Spencer R. 7531

7449 **Hills, L. V.; Jensen, E.** *Capulisporites longiprocessum* n. sp., a possible marker plant spore from the Belly River formation (Campanian) of Alberta, Canada: Canadian Jour. Earth Sci., v. 3, no. 4, p. 413-417, illus., table, 1966.

Capulisporites longiprocessum, a new species of plant spore, is described and illustrated from the Belly River formation of westcentral Alberta. A preliminary palynological study of the Belly River, Edmonton, and Paskapoo formations suggests that this spore is restricted to the Belly River formation. This conclusion is strengthened by the earlier studies of Campbell (1962), who indicated that spores of this type were confined to strata of pre-Edmonton age.—Authors' abstract

7313 **Hinds, Jim S.** Geologic map of the Johnson Trading Post quadrangle, Sandoval County, New Mexico: U.S. Geol. Survey Geol. Quad. Map GQ-591, scale 1:24,000, section, text, 1966.

Nine wells have been drilled for oil and gas in the Johnson Trading Post quadrangle, but oil was produced only from one in the Late Jurassic Entrada Sandstone and one in the Late Cretaceous Gallup Sandstone; both wells are now abandoned. Coal, exposed at three places as undivided Kirtland Shale and Fruitland Formation, is silty and in thin lenticular beds; one bed, partially exposed, is more than five feet thick.—M.C.M.

7363 **Hoare, J. M.; Condon, W. H.** Geologic map of the Kwiguk and Black quadrangles, western Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-469, scale 1:250,000, separate text, 1966.

Rocks exposed in the Kwiguk and Black quadrangles range in age from mid Jurassic(?) to Quaternary. Bedrock consists of an old group of deformed, dominantly volcanic rocks, a younger group of deformed sedimentary rocks, intrusive igneous rocks, and young undeformed lava flows. The major structural feature is a northeast-trending belt of intensely folded Mesozoic sedimentary rocks cut by two sets of faults. Unconsolidated surficial deposits, largely silt of Quaternary age, cover more than half the area. No mineralized rocks or areas of hydrothermal alteration were noted during geologic investigations.—M.C.M.

7660 **Hobbs, B. E.; Talbot, J. L.** The analysis of strain in deformed rocks: Jour. Geology, v. 74, no. 4, p. 500-513, 1966.

The conclusions reached in this discussion are (1) the initial shapes of many geological markers used in strain analysis do not lie within a sufficiently small range to give useful results; (2) even if the initial shapes are known within a small range, there is generally not enough information recorded in the rock to solve the mathematical problem unless assumptions concerning the state of strain are made; and (3) in general, assumptions made by geologists concerning states of strain in deformed rocks are not justified, since they are often part of the information sought.—A.T.M.

7244 **Hobson, G. D.** Seismic evidence defining geology in the Gulf of St. Lawrence [abs.]: Oilweek, v. 17, no. 30, p. 42, 1966.

7459 **Hobson, G. D.; Louis, M. C.** (editors). Advances in organic geochemistry, 1964—Internat. Mtg., Rueil-Malmaison, 1964, Proc.: Oxford, England, Pergamon Press (Internat. Ser. Mons. Earth Sci., V. 24), 330 p., illus., tables, 1966.

This volume contains the proceedings of the Second International Congress on Organic Geochemistry, held at Rueil Malmaison, near Paris, Sept. 1964. Two of the 23 papers, and an abstract are cited separately.—E.S.L.

Hobson, George D. *See* Ewing, G. N. 7455

7518 **Hodge, Dennis S.** Preliminary gravity study of the southern Laramie Mountains—Anorthosite areas and adjacent basins: Wyoming Univ. Contr. Geology, v. 5, no. 1, p. 55-62, illus., 1966.

A broad asymmetrical anticline forms the southern Laramie Mts., with the Precambrian exposed in the core. It is bounded by the Denver-Julesburg and Laramie basins. Rocks in the area surveyed are syenites, norites, hornblende gneiss, Sherman Granite, anorthosite, and sedimentary rocks in the basins. Four profiles are given. Good correlations exist between the gravity field and geology. Anomalies within the core are greater than those between the Precambrian and adjoining basins. Relatively low values, -145 to -165 mgal are found over anorthosite, and high values of -175 mgal over Sherman Granite. A hypothetical model indicates that this density contrast extends to a depth of about 7 km.—E.S.L.

Holland, F. D., Jr. *See* Chinburg, Wayne, 7466

7467 **Holland, F. D., Jr.; Crawford, Jack W.; Archbold, Michael F.** *Triceratops* in North Dakota [abs.]: North Dakota Acad. Sci. Proc. 1965, v. 19, p. 223–224, 1966.

7267 **Holman, J. Alan.** Some Pleistocene turtles from Illinois: Illinois Acad. Sci. Trans., v. 59, no. 3, p. 214–216, illus., 1966.

Three species of turtles from gravels of the Clear Lake Pleistocene (Wisconsonian) site near Springfield, Sangamon County, Ill., represent forms that occur in the area today.—Author's abstract

Holman, R. H. C. *See* Washington, R. A. 7272

7355 **Holmes, K. H.** Stratigraphic traps in Cedardale–Northwest Quinlan area, Major and Woodward Counties: Shale Shaker, v. 16, no. 8, p. 174–182, illus., 1966.

The Cedardale and Northwest Quinlan oil and gas fields are used to illustrate stratigraphic entrapment on Oklahoma's northern Anadarko Shelf. They produce from several horizons in the Mississippian and Pennsylvanian; the stratigraphy and structure are described briefly. Five electric log cross sections are discussed, and the history of development traced.—E.S.L.

7403 **Holowaychuk, N.; Petro, J. H.; Finney, H. R.; Farnham, R. S.; Gersper, P. L.** Soils of Ogotoruk Creek watershed, Chap. 13 *in* Environment of the Cape Thompson region, Alaska: U.S. Atomic Energy Comm. Rept. PNE-481, p. 221–273, illus., tables, 1966.

Soils of the watershed are described and discussed with respect to their morphology and physical and chemical properties. They are classified into 19 taxonomic classes and comprise 46 soil mapping units. A map shows the distribution of these units and the several land types in the watershed. Strongly or very strongly acid soils, derived from or influenced by mudstone and graywacke materials, are the most extensive. Medium acid to mildly alkaline or calcareous soils occur in the western part of the watershed but are less extensive.—*from* Authors' abstract

Holser, William T. *See* Kennedy, George C. 7338

7609 **Hope, Roger Allen.** Geology and structural setting of the eastern Transverse Ranges, southern California [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, p. 209B–210B, 1966.

7275 **Houtermans, F. G.** History of the K/Ar method of geochronology, *in* Potassium argon dating: New York, Springer-Verlag, p. 1–6, illus., table, 1966.

The K–Ar method of absolute age determination evolved, following the discovery of β activity of potassium in 1905, and of γ-activity in 1928, from the conclusion, based on Ar-40 abundance, that the total activity of K is due to K-40 and the suggestion that the measurement of Ar-40 in minerals could be used as a dating method. Gentner and his school found the first reliable age determination, in 1954, by emphasizing the extreme importance of sampling.—E.S.L.

7285 **Howard, Hildegarde.** Pliocene birds from Chihuahua, Mexico: Los Angeles County Mus. Contr. Sci., no. 94, 12 p., illus., 1966.

Seven birds from the Yepómera fauna of the Rio Papigochic valley, Mexico, are discussed, only one of which had been previously recorded from the area. All appear to be extinct, and one [duck, *Wasonaka yepomerae*] is described as a new genus and species.—Author's abstract

7286 **Howard, Hildegarde.** A possible ancestor of the Lucas Auk (family Mancallidae) from the Tertiary of Orange County, California: Los Angeles County Mus. Contr. Sci., no. 101, 8 p., illus., tables, 1966.

A recently discovered marine deposit, of presumably late Miocene age, at Laguna Hills, California, has yielded an avifauna of eight or more species. One of these is described as a new genus and species of flightless "auk", family Mancallidae.

The wing bones of the new form are less modified for swimming than are those of typical *Mancalla* and suggest an earlier evolutionary stage of development.—Author's abstract

7675 **Howard, James D.; Henry, Vernon J., Jr.** Sampling device for semiconsolidated and unconsolidated sediments: Jour. Sed. Petrology, v. 36, no. 3, p. 818–820, illus., 1966.

Undisturbed oriented samples of sedimentary structures in semiconsolidated and unconsolidated sediments can be obtained from subaerial and shallow subaqueous environments by using plastic Petri dishes. Samples thus obtained can be radiographed, photographed, used to take peels, impregnated for making thin sections and sieved.—Authors' abstract

7698 **Howe, John A.** The Oligocene rodent *Ischyromys* in Nebraska: Jour. Paleontology, v. 40, no. 5, p. 1200–1210, illus., 1966.

The genus *Ischyromys* in the Brule Formation, Oligocene, Nebraska, appears to be monophyletic and ranges from the lower Orella Member into the basal Whitney Member. The Whitney specimen is the first to be recovered from unreworked sediments in that member in Nebraska. Changes in the lineage occurred with time but appear to have been gradual, and speciation is facilitated by the presence of breaks in the geologic record and unfossiliferous strata. These breaks occurred at well-defined stratigraphic markers known as fossil soils or paleosols which divide Orella Member into lower, middle, and upper. *Ischyromys parvidens* seems to be represented in the lower, *I. typus* in the middle and *I. pliacus* in the upper Orella. A wide range of variation is evident in the materials from each level. Population studies show recognizable differences between the three species.—*from* Author's abstract

7659 **Howie, R. A.; Smith, J. V.** X ray emission microanalysis of rock-forming minerals—[Pt.] 5, Orthopyroxenes: Jour. Geology, v. 74, no. 4, p. 443–462, 1966.

Forty-eight chemically analyzed orthopyroxenes were analyzed by microprobe X-ray emission techniques for Na, Mg, Al, Si, K, Ca, Ti, V, Cr, Mn, Fe, and Ni. Probe determinations for Al, Ca, and Ti are less than the chemical results, whereas those for Si, Mn, and Cr are greater than the chemical. Oxide totals, with Fe assumed to be divalent, range from 97.3 to 101.3 percent, with 34 analyses between 99 and 101 percent. For microprobe data on clinopyroxenes, see Smith, ibid., p. 463.—F.B.

7447 **Howie, R. D.** Catalogue of well samples from Nova Scotia, New Brunswick, Prince Edward Island, and Newfoundland at the Geological Survey of Canada, Ottawa: Canada Geol. Survey Paper 65-40, 43 p., 1966.

This paper is a compilation of available well data for the Atlantic Provinces of Canada. It presents, in tabular form, information for 237 wells, for which sample cuttings and core material is stored at the Geological Survey of Canada.—Author's abstract

Hoyt, John H. *See* Land, Lynton S. 7268

7702 **Huff, Lyman C.; Santos, Elmer; Raabe, R. G.** Mineral resources of the Sycamore Canyon Primitive area, Arizona: U.S. Geol. Survey Bull. 1230-F, p. F1–F19, illus., tables, geol. map, 1966.

Sycamore Canyon Primitive area includes canyons of Sycamore Creek and its tributaries incised deeply into the Colorado Plateau's south edge. Canyon walls are nearly flat-lying sedimentary Paleozoic and Mesozoic rocks which form cliffs, steep slopes, or benches. Oldest formation exposed is Devonian Martin Limestone, overlain by Mississippian–Triassic formations; a series of Tertiary and Quaternary basaltic lava flows form rims of the canyons. Rocks are broken by northwest- and northeast-trending faults with most displacements less than 250 feet; two conspicuous sets of joints parallel the two trends. No mineral production has been recorded; geologic and geochemical reconnaissance have yielded no evidence of

mineral deposits or ore forming minerals. No geologic evidence was found that would justify wildcat exploration for mineral and petroleum deposits at greater depths than the canyon bottoms.—*from* Authors' abstract

7232 **Hughes, N. F.; Moody-Stuart, Judith.** Descriptions of schizaeaceous spores taken from Early Cretaceous macrofossils: Palaeontology, v. 9, pt. 2, p. 274–289, illus., 1966.

Full descriptions are given of spores taken from the original macrofossil material of *Ruffordia goepperti* (Dunk), *Pelletieria valdensis* Seward, and *Schizaeopsis americana* Berry. All three plants are of Early Cretaceous age, the first two from the Lower Wealden of England, and the last from the Patuxent Formation of the Potomac Group of Virginia, U.S.A. The use of measurements in the erection of species in the dispersed spore genus *Cicatricopsisporites* is discussed in the light of these observations.—Authors' abstract

7645 **Hunter, Ralph E.** Sand and gravel resources of Tazewell County, Illinois: Illinois Geol. Survey Circ. 399, 22 p., illus., tables, 1966.

Tazewell County has large amounts of sand and gravel, most of which were deposited by meltwater from glaciers during the Pleistocene Epoch or Ice Age. These deposits are found principally in valleys that served as major channels for the meltwater, in the vicinity of the Illinois River, Mackinaw River, and Farm Creek. Smaller amounts are found in deposits from glacial meltwater away from these streams, in sand dunes, and in stream alluvium. Geographical locations of the deposits have been mapped on the scale 1:62,500.—Author's abstract

7471 **Huntington, Harriet E.** The Yosemite story: Garden City, N. Y., Doubleday and Co., 96 p., illus., 1966.

Beginning with the discovery and development of Yosemite Valley, a popular account of the geologic background is given, including the ancestral mountain systems, glaciation, and uplifts of the Sierra Nevada. The escarpment, granite types, domes, and erosion are described and pictured. A geologic timetable for the area and a glossary are included.—E.S.L.

7280 **Hurley, P. M.** K–Ar dating of sediments, *in* Potassium argon dating: New York, Springer-Verlag, p. 134–151, illus., tables, 1966.

The only possibility for dating sediments is to date truly authigenic materials which became closed systems at the time of sedimentation. The study of glauconite, comparison of glauconite ages with accepted time scales, its use in dating the Proterozoic, and evidence on the age of the Cambrian are examined in detail. Measurements on whole rock samples of shale and pelagic sediments are discussed and tabulated, and a section is included on age of detrital components in clastic sediments in the study of paleotectonics.—E.S.L.

Hurley, P. M. *See* Fairbairn, H. W. 7453

7713 **Husted, John E.** Progress report of the state of Georgia's exploration program in the Coastal Plain [abs.]: Mining Eng., v. 18, no. 8, p. 42, 1966.

7385 **Inman, D. L.; Ewing, G. C.; Corliss, J. B.** Coastal sand dunes of Guerrero Negro, Baja California, Mexico: Geol. Soc. America Bull., v. 77, no. 8, p. 787–802, illus., tables, 1966.

Barchan ridges in a dune field of about 40 sq km have moved inland from a barrier beach to form a sand partition across large lagoons. Observations over 3.5 years show that the dunes moved with a mean velocity of 18 m per year and that the sand discharge rate is compatible with the volume of sand required to build the dune field across the lagoons during the 1,800 year existence of the barrier beach. Spring tides inundate interdune areas and subject the windward margins of the dunes to small waves that form miniature barrier beaches. Because these miniature beaches are preserved during dune migration, biweekly and monthly time is marked in the sediments.—J.G.V.

7364 **Ireland, H. A.** Silurian arenaceous foraminifera from subsurface strata of northeastern Kansas: Micropaleontology, v. 12, no. 2, p. 215–234, illus., 1966.

Foraminifera were extracted from acid residues of oil well samples from the Hunton Group in the subsurface Salina and Forest City Basins, northeastern Kansas. The fauna was restricted to the Niagaran portion of the Silurian beds, equivalent to Clarita Member of Chimneyhill Limestone, Arbuckle Mountains, Okla. Several thousand specimens were used to correlate southward into Oklahoma and eastward into Missouri, Indiana and Kentucky. The information made it possible to divide the Hunton into two Devonian and five Silurian zones, to identify previously unknown faults, and to account for anomalous thicknesses and paleogeologic aspects. Twenty species from eleven genera were identified, including two new species and one new genus. The work extends the known occurrence of Silurian foraminifera 500 miles north and 500 miles west of previously described localities.—*from* Author's abstract

James, A. H. *See* Peters, W. C. 7528

7710 **Jelinek, Arthur J.** Radiocarbon dating in the Southwest United States, *in* Internat. Conf. Radiocarbon and Tritium Dating, 6th, 1965, Proc.: U.S. Atomic Energy Comm. Rept. CONF–650652, p. 133–144, illus. [1966?].

Major time gaps in the C–14 record of the southwestern United States—from 8900 to 7500 B.C., and 4900 to 3300 B.C.—correspond to the post–Valders warming trend, and the Altithermal, respectively. They probably represent removal of cultural material by erosion. Distribution of the sites is described; the Cochise tradition is the best known, and its phases and associated dates are discussed. More groups of dates are needed to fill in knowledge of these cultures.—E.S.L.

7435 **Jenness, S. E.** The anorthosite of northern Cape Breton Island, Nova Scotia—A petrological enigma: Canada Geol. Survey Paper 66–21, 25 p., illus., tables, 1966.

Several small lenses of anorthosite outcrop within a band of metavolcanic rocks near the northern tip of Cape Breton Island. The largest body is seven miles long with a width of 1/8 to 3/4 mile. After study of 41 anorthosite specimens and 25 thin sections, it is concluded that petrographic descriptions of this largest body are applicable to all. Chemical and modal analyses are given, and origin and age discussed. The anorthosite is probably older than the Devonian granitic rocks, and younger than the metavolcanic; a Proterozoic age is suggested.—E.S.L.

7255 **Jennings, E. W.** The Minnehik–Buck Lake gas field [abs.]: Oilweek, v. 17, no. 30, p. 42, 1966.

Jensen, E. *See* Hills, L. V. 7449

7549 **Jerome, S. E.** Some features pertinent in exploration of porphyry copper deposits, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 75–85, illus., reprinted 1966; originally published 1963.

The geologic events involved in a typical porphyry copper district are shown in an idealized cross section, with the geochemical and geophysical expressions indicated. Several types of primary orebodies that may form are described, and some significant departures from the typical are discussed. The alteration pattern, physical and chemical changes attributable to alteration of the intrusive, major and minor metal distribution, and color anomalies, are phases of geochemical expression discussed. Several geophysical methods are given.—E.S.L.

Jespersen, Anna. *See* Henderson, John R., Jr. 7632

7472 **Jillson, Willard Rouse.** The geology of Estill County, Kentucky: Frankfort, Ky., Roberts Printing Co., 112 p., illus., tables, 1966.

In this treatise an effort has been made to detail the less obvious phases of the geology of this district as well as those more readily apparent. Two features, long overlooked, are presented for the first time: the lately abandoned Pea Ridge

meander, and the ancient and long extinct waterfalls of the Kentucky River, which, receding 15–20 miles to the southeast during the Tertiary, disappeared below drainage levels before the advent of man. Also included are illustrated descriptions of the stratigraphy, structure, paleontology, and mineral resources of Estill County, and an account of the development of the oil and gas fields, in particular the gas field in the St. Peter (Ordovician) sand in the area about "Old Furnace Post Office".—G.D.C.

Johnson, David W. *See* Olmstead, Hugh W. 7566

Johnson, J. G. *See* Boucot, A. J. 7519

7290 **Johnston, F. J.** Vermilion Lake area, District of Kenora: Ontario Dept. Mines Prelim. Geol. Maps P.336–337, 2 sheets, scale 1 in to 1/4 mi., text, 1966.

The oldest group of rocks in the Vermilion Lake area consists of a conformable succession of south and southeast–facing volcanic, sedimentary, and pyroclastic rocks. Granitic rocks are the youngest and occupy much of the area west and north of Lost Lake. Shearing accompanied by heavy carbonatization is conspicuous on some of the islands of Vermilion Lake; widespread shearing occurs in other sections. The Little Vermilion fault trends northeast and separates volcanic rocks that lie to the southeast from the main belt of metasedimentary rocks. All observed occurrences of iron formation are well below economic grade, but in some cases contain sulfides, and bear further exploration. Some quartz vein material contains small amounts of copper and gold. Map Sheet 336 shows the western part and 337 the eastern part of the map area.—M.C.M.

7485 **Jonas, Edward C.; Kuykendall, Joseph R.** Preparation of montmorillonites for random powder diffraction: Clay Minerals, v. 6, no. 3, p. 232–235, illus., 1966.

Montmorillonites used were from the Black Hills, S. Dak., Clay Spur, Wyo., Twiggs County, Ga., and Gonzales County, Tex. The preparation technique described results in an aggregation of crystallites randomly enough oriented that the powder can be handled without introducing preferential orientation. A dilute suspension of montmorillonite in water is spray–dried, and the dust collected on an electrostatic precipitator. The apparatus, based on a throat sprayer, is described and illustrated. The patterns are discussed briefly.—E.S.L.

7245 **Jones, G. H. S.** Structural pattern of the Snowball Crater at Suffield [abs.]: Oilweek, v. 17, no. 30, p. 42, 1966.

7676 **Jopling, Alan V.; Richardson, Everett V.** Backset bedding developed in shooting flow in laboratory experiments: Jour. Sed. Petrology, v. 36, no. 3, p. 821–825, illus., 1966.

Backset bedding was produced in a laboratory flume by feeding sand into a shooting (supercritical) flow that terminated downstream in a hydraulic jump. Sediment accumulated at the site of the jump, increasing the tailwater depth and causing the jump to move upstream. Concurrently, the sediment mound grew in both upstream and downstream directions. Downstream growth formed typical foreset bedding, whereas upstream growth resulted in deposition of backset bedding inclined in the up–current direction. Backset bedding was also produced in experiments where antidune and chute and pool bed configurations were formed in a recirculating flume. These experiments support Davis' theory of the origin of backset bedding in fluvioglacial outwash deposits of New England and offer a plausible explanation for this type of cross–bedding in other sedimentary formations.—E.J.C.

7229 **Kachadoorian, Reuben.** Engineering geology of the Chariot site, Chap. 5 *in* Environment of the Cape Thompson region, Alaska: U.S. Atomic Energy Comm. Rept. PNE–481, p. 85–96, illus., tables, geol. map, 1966.

The Chariot site lies entirely in frozen mudstone of the Ogotoruk Formation, Jurassic or Cretaceous. The mudstone has been complexly folded and faulted and locally overturned. The results of thin–section and X–ray analyses are given and lithologic logs of four drill holes are included. The cores show numerous fault

zones. The mudstone is mantled by unconsolidated deposits of Quaternary age, from 5 to 30 feet thick, forming ancient beaches, terraces, colluvium, floodplains, alluvial fans, swamps, silt and sand, and beaches. The Chariot site is underlain by permafrost from within 1 ft of the surface to depths up to 1,165 feet. Ice wedges and lenses are extensive, and locally ice heals the joints in the mudstone.—E.S.L.

Kalbitzer, S. *See* Fechtig, H. 7277

7282 **Kanakoff, George P.** A new species of *Boetica* from the Pliocene of California: Los Angeles County Mus. Contr. Sci., no. 103, 4 p., illus., 1966.

Boetica hertleini, a new species of [gastropod] mollusk apparently belonging to the family Lacunidae, is described from Pliocene deposits of Los Angeles County, California.—Author's abstract

Kanasewich, E. R. *See* Clowes, R. M. 7260

7320 **Kane, M. F.; Bromery, R. W.** Simple Bouguer gravity map of Maine: U.S. Geol. Survey Geophys. Inv. Map GP-580, scale 1:500,000, 1966.

Karner, Frank R. *See* Helgesen, John O. 7464

7289 **Kauffman, A. E.; Roth, R. I.** Upper Pennsylvanian and Lower Permian fusulinids from north-central Texas: Cushman Found. Foram. Research Spec. Pub. 8, 49 p., illus., tables, 1966.

Fusulinids collected mainly from Virgilian (Cisco) rocks but including some from the upper Missourian (Canyon) and Lower Permian (Wolfcampian) are described and illustrated. One species of *Schubertella*, 3 of *Dumbarinella*, and 10 of *Triticites* are recognized as new. Also, *Triticites plummeri* Dunbar and Condra is divided into three subspecies. The Belknap Limestone, commonly regarded as Upper Pennsylvanian (Cisco), is assigned to the Wolfcampian, Permian, because of the occurrence of characteristic Lower Permian fusulinids.—Authors' abstract

7648 **Keating, L. F.** Exploration in the Canadian Rockies and Foothills: Canadian Jour. Earth Sci., v. 3, no. 5, p. 713–723, illus., 1966.

The Canadian Rockies form the most easterly ranges of the Cordilleran system for more than 1,000 miles; they are bounded on the east by the Interior Plains and on the west by the Rocky Mtn. Trench. The main deformation occurred during Eocene, resulting in a system of stacked thrust plates which do not involve the crystalline basement rocks; more than 100 miles of shortening occurred. The structure of the foothills is discussed and illustrated with sections. The success of oil and gas exploration can be attributed to an understanding of the structures of the Rockies, and intelligent application of geological and geophysical methods to their location. A wealth of structural information has been accumulated. The 1,008 crew months of seismic work, about equally divided between refraction and reflection, have been completed; both are essential for structural interpretation.—E.S.L.

Keefer, David K. *See* Knight, Samuel H. 7512

7530 **Kehoe, Thomas F.** The distribution and implications of fluted points in Saskatchewan: Am. Antiquity, v. 31, no. 4, p. 530–539, illus., 1966.

Classic Clovis, classic Folsom, and atypical fluted points from southern Saskatchewan are described. The variations in the atypical fluted points, which include three fluted Plano points, suggest that the parallel-flaked tradition was developed out of the fluted tradition in the centuries of rapid climatic shift following the retreat of the Valders ice . . . in the region that included southern Saskatchewan.—Author's abstract

7516 **Kelley, James C.** A Fortran IV program for the determination of rotation axes from fabric data: Wyoming Univ. Contr. Geology, v. 5, no. 1, p. 39–44, illus., 1966.

Graphical techniques for the analysis of fabric data are not wholly satisfactory due to their inherent imprecision. The difficulties of the graphical approach may be overcome by direct mathematical analysis. Given a simple assumption, rotation axes exhibited by fabric data may be determined by a least squares criterion. Author's abstract

7264 **Kempton, John P.** Radiocarbon dates from Altonian and Twocreekian deposits at Sycamore, Illinois: Illinois Acad. Sci. Trans., v. 59, no. 1, p. 39–42, illus., 1966.

Two radiocarbon dates have been determined for wood collected from an exposure in a gravel pit in the valley of East Branch Kishwaukee River at the northern edge of Sycamore, Ill. Wood chips in the lower part of the exposure collected from pinkish gray outwash, part of the youngest drift of the Altonian Substage, were dated as older than 32,000 years B. P. . . . A log near the top of the exposure in a lenticular black organic silt deposited during the Twocreekian Substage was dated at 12,000±400 radiocarbon years B. P. . . .—Author's abstract

7338 **Kennedy, George C.; Holser, William T.** Pressure–volume–temperature and phase relations of water and carbon dioxide, Sec. 16 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 371–383, illus., tables, 1966.

Relationships between various forms of solid H_2O and solid–liquid H_2O equilibria are well understood from past work of P. W. Bridgman; these relationships and Bridgman's curve (1914) for solid–liquid equilibrium in CO_2 are shown in a phase diagram. Specific volumes of water in cm^3/gm as a function of pressure and temperature are shown in one table, specific volumes of water at saturation in the second table. A third table gives density, pressure, and temperature data for CO_2, taken from Kennedy (1954).—G.D.C.

7598 **Kier, Porter M.** Four new Eocene echinoids from Barbados: Smithsonian Misc. Colln., v. 151, no. 9 (Pub. 4673), 28 p., illus., 1966.

Two new species of *Cassidulus*, one of *Echinocyamus*, and one of *Fibularia*, are described from the middle Eocene Upper Scotland Formation in Barbados, West Indies. Variation and ontogeny of *Fibularia barbadoensis* were studied from the large number of specimens; no evolutionary trends were found. Other Caribbean and American species of *Echinocyamus* and *Fibularia*, many inadequately described previously, were reexamined for comparison with the new species. Measurement data are presented on scatter diagrams, and drawings show for the first time the location of petal pores, the most diagnostic feature in these species.—V.M.J.

7484 **King, John S.; Parker, Ronald B.** The interpretation of folded transposition layering near Twin Mountains, Laramie Range, Wyoming: Wyoming Univ. Contr. Geology, v. 5, no. 1, p. 63–68, illus., 1966.

The detailed study of a megascopic fold in the southern Laramie Range of Wyoming demonstrated that the prominent foliation present in the metamorphic series is not preserved sedimentary layering [but is result of transposition of pre-existing planar anisotropy]. This is so in spite of the fact that the map units are of approximately equal thickness and are continuous over significant distances within the mapped area. Furthermore, an intimate relationship between one of the fine grained foliated metamorphic rock units and a pegmatite of similar mineral paragenesis suggests derivation of the latter from the former by recrystallization controlled by the structure and by the mineral association of the rock type involved.—Authors' abstract

7564 **Kinnison, John E.** The Mission copper deposit, Arizona, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 281–287, illus., 1966.

Bedrock surface, in the Mission mine area near Tucson, is a buried pediment, and only a few small outcrops protrude. Hypogene sulfides are within 50 feet below the bedrock surface, with only a very thin veneer of secondary enrichment, the process of pedimentation having removed the original blanket. Alteration is pervasive in the deposit, and sulfides are disseminated in all rocks in the altered

zone. The monzonite porphyry has no specific spatial relation to ore or alteration, but probably has an indirect genetic relation to mineralization.—E.S.L.

Kinori, B. Z. *See* Ben-Zvi, A. 7557

7240 **Kirsten, T.** Determination of radiogenic argon, *in* Potassium argon dating: New York, Springer-Verlag, p. 7–39, illus., 1966.

The extraction of gases by heat or chemical flux, with descriptions of furnace types, the separation of Ar from the extracted gas, and storage of the samples comprises the first part of the paper. The section on determination is divided into volumetric and mass spectrometric analysis, with a detailed account of the operation of the spectrometer. The absolute calibration of the noble gas isotopes is made by comparison with a standard gas sample. Preparation of these standards is discussed, and direct calibration with pipettes and the isotope dilution method described. A short section is devoted to neutron activation analysis.—E.S.L.

7644 **Kjellesvig-Waering, Erik.** A revision of the families and genera of the Stylonuracea (Eurypterida): Fieldiana—Geology, v. 14, no. 9, p. 169–197, illus., 1966.

Most eurypterids of the worldwide Paleozoic superfamily Stylonuracea were formerly assigned to the family Stylonuridae, to *Stylonurus* in particular. Størmer (1951) was first to apply structure of the prosomal ventral shield and shape of the metastoma as criteria for separation of the family Rhenopteridae; later the Dolichopteridae, Hibbertopteridae, and Woodwardopteridae were separated. In this paper, the following new families are separated from the Stylonuridae, by the above criteria: Pageidae, Drepanopteridae, Kokomopteridae, Laurieipteridae. All genera, many new, of each family are described, based on shape of carapace, shape and position of eyes, type of opisthoma, and size, shape and count of podomeres. Species referred to each genus are listed.—V.M.J.

7312 **Klemic, Harry.** Geologic map of the Herndon quadrangle, Kentucky-Tennessee: U.S. Geol. Survey Geol. Quad. Map GQ-572, scale 1:24,000, section, text, 1966.

Limestone in the upper part of the St. Louis Limestone is being quarried at the southern edge of the Herndon quadrangle in Tennessee for road metal; two quarries in the Ste. Genevieve Limestone are abandoned.—M.C.M.

7512 **Knight, Samuel H.; Keefer, David K.** Preliminary report on the Precambrian stromatolites in the Nash Formation, Medicine Bow Mountains, Wyoming: Wyoming Univ. Contr. Geology, v. 5, no. 1, p. 1–11, illus., 1966.

The field relations and megascopic character of three types of stromatolites, and the bioherms, occurring in the lower half of what is herein defined as the Nash Formation, are described and illustrated. The Nash Formation is part of a succession of metasediments occurring in the Precambrian complex of the Medicine Bow Mts. It is believed to be not less than 1.7 b.y. old. Field studies support the conclusion that the stromatolites and bioherms are organo-sedimentary features.—E.S.L.

Knisel, Walter G. *See* Blank, Horace, 7469

7454 **Kornik, L. J.; MacLaren, A. S.** Aeromagnetic study of the Churchill-Superior boundary in northern Manitoba: Canadian Jour. Earth Sci., v. 3, no. 4, p. 547–557, illus., 1966.

The proposed Churchill-Superior boundary is correlated with a narrow, continuous magnetic low that changes at its north end from a northeast to an east-west trend approximately paralleling the 56° N. latitude line. The date pattern of age determinations supports this position of the boundary, and aeromagnetic patterns correlate closely with the geology. Anomalies appear to be produced chiefly by near-surface material. Gravity patterns appear to be independent of geologic and aeromagnetic patterns, and are probably produced by larger scale density contrasts, and a deeper source.—E.S.L.

7630 **Koteff, Carl.** Surficial geologic map of the Clinton quadrangle, Worcester County, Massachusetts: U.S. Geol. Survey Geol. Quad. Map GQ–567, scale 1:24,000, separate text, 1966.

Surficial deposits in the Clinton quadrangle consist of till, uncorrelated glacial stream and lake deposits, glacial lake deposits, North Brook valley deposits, undivided sand and gravel, river terrace deposits, and alluvium. Glacial and postglacial history of these deposits is discussed in relation to changes produced by glaciation. The most important surficial economic deposits are sand and gravel; clay in significant amounts occurs only in the northeastern part; till, swamp deposits, alluvium, and windblown silt are of economic value also.—M.C.M.

7335 **Kracek, F. C.; Clark, Sydney P., Jr.** Melting and transformation points in oxide and silicate systems at low pressure, Sec. 13 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 301–322, illus., 1966.

The material in this section has been condensed from a more extensive summary which Kracek completed just before his death in 1960. Certain binary systems are included in ternary data, and hydrous minerals, carbonates and sulfide minerals are covered elsewhere in this handbook, as are investigations above atmospheric pressure. Brief descriptions of oxide and silicate mineral systems are listed, drawn from previously published tables. The systems are grouped in the following order: those involving a single metal ion, binary systems not involving SiO_2, binary silicate systems, ternary systems, and quaternary and quinary systems. Phase diagrams illustrate a number of the systems.—G.D.C.

7436 **Kranck, Kate.** Sediments of Exeter Bay, Baffin Island, District of Franklin: Canada Geol. Survey Paper 66–8, 60 p., illus., tables, 1966.

Results of the first marine geological work along the east coast of Baffin Island are presented. More than 100 bottom samples were collected from about two miles offshore to a few miles beyond the continental shelf, with about one mile between stations. A marked feature is the widespread distribution of coarse gravel on both shelf and slope; both local and foreign rock types are present. The heavy minerals of the sand fraction are discussed and shown on maps. Current transportation is indicated as the most active process inshore, whereas ice rafting predominates on the offshore shelf and slope.—E.S.L.

7281 **Krankowsky, D.; Zähringer, J.** K–Ar ages of meteorites, *in* Potassium argon dating: New York, Springer Verlag, p. 174–200, illus., tables, 1966.

This study shows that single specimens from the same meteorite give fairly constant K–Ar ratios, even with differing K content. Furthermore using the average Ar and K values for different meteorites, the age values all fall between 5 and 7.5 billion years. The fact that all meteorites do not have a single age is due either to their complex history, or possibly, derivation from different parent bodies. It is hoped that from these variations more information on the history of meteorite evolution can be obtained. At present it appears that the parent bodies had formed and started to cool about 6.3 b.y. ago. This would mean that the history of the planetary system started earlier than has been thought.—E.S.L.

7670 **Kravitz, Joseph H.** Using an ultrasonic disruptor as an aid to wet sieving: Jour. Sed. Petrology, v. 36, no. 3, p. 811–812, 1966.

Dispersion of fine grained sediment in water may be effected by means of a submersible ultrasonic disruptor. The instrument has several different power settings.—R.A.C.

Krinitzsky, E. L. *See* Stanley, D. J. 7390

Kriz, George J. *See* Lewis, David C. 7506

7553 **Kriz, George J.; Scott, Verne H.; Burgy, Robert H.** Graphical determination of confined aquifer parameters: Am. Soc. Civil Engineers Proc., v. 92, paper 4899, Jour. Hydraulics Div., no. HY 5, p. 39–48, illus., tables, 1966.

Dimensional analysis is used to obtain a relationship between the parameters of a homogeneous, isotropic confined aquifer. A dimensionless form of the fundamental differential equation governing the transient flow of ground water toward a fully penetrating well in an infinite confined aquifer is solved analytically and numerically. Graphical methods of solution are proposed for the determination of any one of the parameters provided the other parameters are known. Field data are used to compare the proposed method with existing methods of determining the coefficients of transmissibility and storage of a confined aquifer.—Authors' abstract

7554 **Kriz, George J.; Scott, Verne H.; Burgy, Robert H.** Analyses of parameters of an unconfined aquifer: Am. Soc. Civil Engineers Proc., v. 92, paper 4901, Jour. Hydraulics Div., no. HY 5, p. 49–56, illus., table, 1966.

The relationship between the parameters of a homogeneous, isotropic unconfined aquifer are described by dimensional analysis. A dimensionless form of the nonlinear differential equation governing the flow of ground water toward a fully penetrating well in an infinite unconfined aquifer is solved numerically. Graphical methods of solution are proposed for the determination of any one of the parameters provided the other parameters are known. A field test is included to illustrate the proposed method.—Authors' abstract

7336 **Kullerud, G.** Phase relations in sulfide-type systems, Sec. 14 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 323–343, illus., 1966.

Various phase relations of sulfide-type minerals and compounds in binary, tertiary, and quaternary systems are compiled in summary form, and illustrated by diagrams.—G.D.C.

7691 **Kumarapeli, P. S.; Saull, V. A.** The St. Lawrence valley system—A North American equivalent of the East African rift valley system: Canadian Jour. Earth Sci., v. 3, no. 5, p. 639–658, illus., 1966.

The St. Lawrence valley system is coextensive with a well-defined pattern of seismic activity. It is in a region of updoming, normal faults, and distinctive alkaline igneous activity. Evidence presented indicates the presence of a major rift valley system with crustal tension possibly related to opening of the Atlantic basin as postulated in the continental drift theory. Possible extensions within the continent are discussed and shown on a map, and this extended system is compared with the East African rift zones. A possible connection with the global system of rifts is traced, and illustrated by maps. This rift-valley hypothesis may be useful in the search for niobium-bearing complexes and diamond-bearing kimberlites.—E.S.L.

7655 **Kunze, H. L.; Smith, J. T.** Base-flow studies, upper Guadalupe River basin, Texas—Quantity and quality, March 1965: Texas Water Devel. Board Rept. 29, 33 p., illus., tables, geol. map, 1966.

Base flow of the upper Guadalupe River and its tributaries is sustained entirely by ground-water effluent; its main source is discharge of water from the aquifers which are principally Edwards and associated limestones. Although both amount and chemical quality of base flow are closely related to the source, they vary considerably because of seasonal and man-made environmental changes. Water throughout the area is of calcium and magnesium bicarbonate composition, typical of water draining from a limestone terrain, and is very hard.—M.C.M.

7397 **Kurie, Andrews Edmunds.** Recurrent structural disturbance of Colorado Plateau margin near Zion National Park, Utah: Geol. Soc. America Bull., v. 77, no. 8, p. 867–871, illus., geol. map, 1966.

The area of the Kanama anticline and Hurricane fault zone were remapped. The anticline was formed, locally overturned to the east, and cut by the Taylor Creek thrust during Laramide time. The Hurricane zone of normal faults developed parallel to the anticline in late Cenozoic time. Major Laramide as well as late Cenozoic relief is indicated.—J.J.H.

7690 **Kurtén, Björn.** Pleistocene bears of North America—[Pt.] 1, Genus *Tremarctos*, spectacled bears: Acta Zool. Fennica 115, 120 p., illus., tables, 1966.

Classification and history of the Ursidae and of the American subfamily Tremarctinae are outlined briefly. *Tremarctos floridanus* is found in cave deposits of Mexico, Texas, and 16 localities in Florida, ranging from Illinoian or Sangamon to latest Pleistocene. Comparisons with the smaller, living *T. ornatus* of northern South America, and with *Ursus spelaeus*, the Pleistocene European cave bear, and other *Ursus* species, reveal marked convergence of *T. floridanus and U. spelaeus* with respect to great increase of size, great sexual dimorphism in size, and changes in proportions of bones and teeth, suggesting that adaptation to glacial conditions played only a minor role in evolution of *U. spelaeus*. No changes in size or proportions are detectable between the oldest and youngest Florida specimens.—V.M.J.

Kuykendall, Joseph R. *See* Jonas, Edward C. 7485

7400 **Lachenbruch, A. H.; Greene, G. W.; Marshall, B. V.** Permafrost and the geothermal regimes, Chap. 10 *in* Environment of the Cape Thompson region, Alaska: U.S. Atomic Energy Comm. Rept. PNE-481, p. 149-163, illus., 1966.

Analysis of temperatures to a depth of 1,200 feet beneath Ogotoruk Valley reveals that present earth temperatures at depth are strongly influenced by an extinct climate and by an ancient shoreline position. An active climatic change that has been in progress throughout the past century has increased the mean annual ground-surface temperature on the order of 2°C. If the present climate persists, the inland permafrost thickness eventually will be reduced from about 1,170 to about 850 feet. Earth-temperature anomalies near the shoreline indicate a rapid encroachment of the Chukchi Sea several thousand years ago and imply that permafrost extends under the margin of the sea to a maximum distance of about 100 yards at a depth of 200 or 300 feet. Preliminary results indicate that local heat flow from the interior of the Earth is close to the worldwide average.—Authors' abstract

7610 **Laidley, Richard Allan.** An X ray fluorescent analysis study of the distribution of selected elements within the Hopi Buttes volcanics, Navajo County, Arizona [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, p. 210B, 1966.

7479 **Lamar, J. E.** High purity limestones in Illinois: Illinois Geol. Survey Indus. Minerals Note 27, 20 p., illus., table, 1966.

High-purity limestones of various thicknesses occur in western, southwestern, and extreme southern Illinois. The limestone is now being quarried at a number of places. Occurrences of limestone of high purity (more than 95 percent calcium carbonate and more than 97 percent total calcium and magnesium carbonate) are reported by districts, and chemical analyses are given.—Author's abstract

7376 **Lamar, William L.** Chemical character and sedimentation of the waters, Chap. 9 *in* Environment of the Cape Thompson region, Alaska: U.S. Atomic Energy Comm. Rept. PNE-481, p. 133-148, illus., tables, 1966.

Information on ground and stream waters in a coastal belt about 15 mi wide from Point Hope to Kivalina, Alaska, was obtained, principally during the open-water season. Both low chloride and high chloride waters were found; the former were derived from runoff and shallow aquifers. Mineral content of high-chloride waters, a mixture of saline and fresh water, varied greatly; saline component was similar to seawater. The chemical compositions of 32 samples are tabulated.—E.S.L.

7544 **Lance, John F.** Eldred Dewey Wilson, 1898-1965, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. v, 1966.

7268 **Land, Lynton S.; Hoyt, John H.** Sedimentation in a meandering estuary: Sedimentology, v. 6, no. 3, p. 191-207, illus., 1966.

Sand is being deposited in a meandering estuary separating Sapelo and Blackbeard Islands, Ga., in the channel and on two point bars associated with meanders. Sand is being eroded by the meandering channel from Pleistocene and Holocene strandline deposits, and redeposited by ebb tidal currents. The estuary channel deposits are coarse grained and their grain size decreases down ebb current from the source outcrops. The point bars increase in grain size from their crests downward as they grade into channel deposits. Festoon cross bedding and ripple marks on the point bars record the ebb direction; plant fragments are normal to bar elongation. Horizontally stratified muds and muddy sands, deposited behind the bars, contain rich fauna, represented more by burrows than organisms. Sands of the bars and channel are less productive, but the bioclastic content of the sediment is high.—*from* Authors' summary

Laney, R. L. *See* Marsh, Owen T. 7492

7509 **Lange, Arthur L.** Caves of the southern Sierra Nevada in the geologic record, *in* Caves of the Sequoia region, California: Natl. Speleol. Soc. Guidebook 7, p. 3–12, illus., 1966.

The presence of the caves and their role in the evolution of Sierra landscape is explained. Bodies of marble occur as roof pendants, or remnants of marine sediments engulfed by the batholith, and it is in these that solution caves form. Alpine cave systems are forming today, and canyon caves, which formed earlier, were deepened following entrenchment of the canyon. Other caves, found high on the ridges and abandoned by streams, were probably underground lakes during the Pleistocene. Examples of all are described.—E.S.L.

7226 **Lange, G. R.; Smith, T. K.** Drilling, coring, and frozen core analysis, Chap. 6 *in* Environment of the Cape Thompson region, Alaska: U.S. Atomic Energy Comm. Rept. PNE-481, p. 97–114, illus., tables, 1966.

Two holes were drilled and cored to depths of 1,000 and 1,200 feet in the frozen mudstone of the Ogotoruk Formation at the Ogotoruk Creek area, Project Chariot site. Permafrost extends to a depth of approximately 1,000 feet. The hole walls were stabilized, even in zones of very weak rock, by the use of refrigerated diesel fuel as a drilling fluid, and frozen cores of good quality were taken with little difficulty. Special methods of testing were developed for determining physical properties of the cores in their naturally frozen state. The total liquid content determined by oven-drying was found to be greater than that determined by Soxhlet extraction. It is inferred that water content determinations on rock and soil samples as normally carried out in the laboratory often do not reflect the original water content.—*from* Authors' abstract

Langenheim, R. L., Jr. *See* Frost, S. H. 7697

7591 **Larochelle, A.** Palaeomagnetism of the Abitibi dyke swarm [with French abs.]: Canadian Jour. Earth Sci., v. 3, no. 5, p. 671–683, illus., tables, 1966.

Preliminary results recently published (Fahrig et al. 1965) on six Precambrian diabase dike swarms attributed the relatively high angular dispersion to a number of possible factors. These factors were investigated in the light of data obtained for an independent suite of 123 oriented samples from one of the groups of dikes in Quebec. Results suggest that the dikes were injected intermittently over a long period. The high within-dike precision estimates suggest that the dikes have not undergone much metamorphism or rotation since injection. Paleomagnetism appears to be a reliable tool for correlation of diabase dikes within a region.—E.S.L.

7720 **Larochelle, A.** Sur le paléomagnétisme des terrains rouges Permo-Carbonifères de l'est du Canada [discussion of paper by J. L. Roy, 1966]: Canadian Jour. Earth Sci., v. 3, no. 5, p. 730–733, table, 1966.

Possibilities of magnetic cleaning by heating and chilling were studied by Roy and he has suggested that published results on samples from the Prince Edward Island and Bonaventure Formations are of dubious value. Black's work (1964) on the Prince Edward Island directions of magnetization and DuBois' (1959) on

Bonaventure are in good accord with Roy's results (ibid., p. 139, 1966) but this was not mentioned in Roy's paper. Helsley's results, which Roy considered valuable, are tabulated here with the other three. Pole positions derived by Black and DuBois compare to Roy's to the same degree as to Helsley's. If three directions are omitted from Roy's calculations, which he called erratic, the remainder are as well distributed before as after cleaning.—E.S.L.

7296 **Larson, Lawrence T.** Mineral resources summary of the McEwen quadrangle, Tennessee: Nashville, Tennessee Div. Geology, 6 p., 1966.

The accompanying map (Tennessee Div. Geology Geol. Map GM 39–SW) by M. V. Marcher and O. T. Marsh is cited separately. Of the exposed formations in the McEwen quadrangle (Fort Payne, Warsaw, and St. Louis), the Warsaw is the most important as a source of agricultural limestone and crushed general-purpose stone, contains the only quarry, and is about 80 feet thick. Maximum preserved thickness of the St. Louis is about 160 feet and maximum exposed thickness of the Fort Payne about 140 feet. Gravel is present in small isolated pockets or lenses of Tuscaloosa Gravel and in stream bar and channel fill deposits along Hurricane, Blue, and Trace Creeks.—M.C.M.

7297 **Larson, Lawrence T.** Mineral resources summary of the Cumberland Furnace quadrangle, Tennessee: Nashville, Tennessee Div. Geology, 15 p., tables, 1966.

The map accompanying this text (Tennessee Div. Geology Geol. Map GM 302–SE, by O. T. Marsh and M. V. Marcher) is cited separately. Iron ore deposits in the Cumberland Furnace quadrangle are located on or near the crests and spurs of ridges, and are sporadic and pockety. The Warsaw Formation offers the greatest potential as a source of general purpose and agricultural limestone; its thickness ranges from 45 to about 140 feet. Gravel is a potential resource.—M.C.M.

7298 **Larson, Lawrence T.** Mineral resources summary of the Pleasant View quadrangle, Tennessee: Nashville, Tennessee Div. Geology, 6 p., tables, 1966.

This text accompanies Tennessee Div. Geology Geol. Map GM 304–NE by O. T. Marsh and R. E. Lounsbury (cited separately), and describes the limestone resources of the Pleasant View quadrangle. Commercially valuable amounts are found in the Warsaw and St. Louis Limestones, the only exposed formations. Maximum thickness of the Warsaw is 100 feet and of the St. Louis about 180 feet.—M.C.M.

7633 **Larson, Lawrence T.** Mineral resources summary of the Summertown quadrangle, Tennessee: Nashville, Tennessee Div. Geology, 5 p., 1966.

The map accompanying this text (Tennessee Div. Geology Geol. Map GM 51–NE, by M. V. Marcher and R. E. Lounsbury) is cited separately. Mined mineral resources of the Summertown quadrangle are chert from the Mississippian Fort Payne Formation and a small amount of phosphate in the outcrop area of the Bigby limestone facies of the Ordovician Bigby–Cannon Limestone.—M.C.M.

7699 **Laudon, Lowell R.; Hartwig, A. E.; Morgridge, Dean L.; Omernik, John B.** Middle and Late Paleozoic stratigraphy, Alaska–Yukon border area between Yukon and Porcupine rivers: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 9, p. 1868–1889, illus., 1966.

Graphic sections show detail of the Devonian Nation River, Mississippian Calico Bluff, and Permian Tahkandit Formations from localities near Eagle, Alaska. The Devonian age of the Nation River Formation, assigned from evidence presented by Churkin and Brabb (1965), is questioned, and three possible explanations of the stratigraphic relations are illustrated. A fauna of probable Early Pennsylvanian age is listed from the Calico Bluff Formation, and several faunal collections from the Tahkandit are of Permian age. Mississippian, Pennsylvanian, and Permian fauna were obtained from a section of unnamed rocks near the junction of the Salmontrout River with the Porcupine River.—E.K.M.

Laushey, Louis M. *See* Neill, Charles R. 7556

Lawton, K. D. *See* Ramsden, John. 7410

7344 **Lee, W. H. K.; Clark, Sydney P., Jr.** Heat flow and volcanic temperatures, Sec. 22 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 483–511, tables, 1966.

The first determinations of heat flow in the continents were published in 1939 and of oceanic measurements in 1952. About 2,000 available observations, analyzed by Lee and Uyeda (1965), are the basis for tables presented here. Recent oceanic techniques offer deeper penetration with one coring operation. Validity of measurements depends on the assumption that disturbances such as surface temperature fluctuations and ground water circulation do not affect the sea floor; submarine slumping, local relief, and variations in sediment thickness may affect values. In thermally active areas, very high heat flow may occur locally on land or at sea; highest temperatures recorded are in active basaltic lavas. Pyrometric measurements must be corrected for emissivity of the lava and for atmospheric absorption.—G.D.C.

7663 **Leighton, Morris M.; Brophy, John A.** Farmdale glaciation in northern Illinois and southern Wisconsin: Jour. Geology, v. 74, no. 4, p. 478–499, tables, illus., 1966.

The Pecatonica drift clearly was deposited during the Farmdale substage of the Wisconsin stage of glaciation. This deposit overlies deeply weathered Illinoian drift, underlies Iowan loess, and is contemporaneous with Farmdale loess deposits. The radiocarbon age of the drift appears to be about 29,000 to 31,000 yr B.P. The deposits, which cover about 200 sq mi, resulted from a short but rigorous glaciation that deformed bedrock and disrupted earlier drainage patterns.—E.T.R.

7248 **Leslie, G. A.** Gas reserves in Western Canada [abs.]: Oilweek, v. 17, no. 30, p. 32, 1966.

7426 **Levinson, A. A.; Ludwick, John C.** Speculation on the incorporation of boron into argillaceous sediments: Geochim. et Cosmochim. Acta, v. 30, no. 9, p. 855–861, illus., 1966.

A new theory is proposed to explain the incorporation of boron into argillaceous sediments, particularly those of deltas, based on the concept that dissolved boron in river water transfers to the surface of clay-sized particles by an adsorption process in the zone where river and sea waters mix. Differential adsorption of boron from river water according to particle size (the finest adsorbing the most), followed by differential deposition according to particle size, brings about a gradual change in boron content of whole argillaceous rocks from river mouth to open ocean. The linear relationship between boron content and salinity is thus fortuitous.—D.B.V.

7506 **Lewis, David C.; Kriz, George J.; Burgy, Robert H.** Tracer dilution sampling technique to determine hydraulic conductivity of fractured rock: Water Resources Research, v. 2, no. 3, p. 533–542, illus., tables, 1966.

Ground water in foothill and mountain watershed areas commonly occurs in fractured rock. The small well diameters and low apparent ground water velocities in fractured rock require modification of normal techniques for the investigation of unconfined movement. The determination of hydraulic conductivity by the tracer dilution method normally employs injected radioisotope tracers. The dilution is determined by monitoring the isotope activity in the well with a scintillation probe. A modification of this method, using fluorescent dye tracers and physical sampling and analysis to determine dilution, has been applied in small wells with consistent results. Hydraulic conductivities of 0.02 to 0.5 ft/day have been determined in 16 wells [in Placer and Mendocino Counties, Calif.]. Where comparison is possible, these values agree with those determined by pumping tests.—*from* Authors' abstract

Leyden, Robert. *See* Ewing, John. 7695

7421 **Lill, Gordon.** Some of the scientific and technical aspects of Project Mohole: Earthquake Notes, v. 37, no. 2, p. 5–11, 31, illus., 1966.

The National Science Foundation's Project Mohole can contribute a great amount of scientific and engineering information beneficial to the earth sciences and to both industry and the governmental agencies. Considerable detail is presented on these benefits to geophysics, astrophysics, marine engineering, and even to the space program.—Author's abstract

7347 **Lindsley, D. H.; Andreasen, G. E.; Balsley, J. R.** Magnetic properties of rocks and minerals, Sec. 25 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 543–552, illus., tables, 1966.

Magnetism induced by an external field is a function of the magnetic susceptibility of a rock. Most minerals are paramagnetic or diamagnetic with positive or negative susceptibilities of the order of 10^{-6} c.g.s. units; for ferromagnetic materials the intensity of magnetism reaches a maximum; susceptibility may exceed unity. The susceptibility of a rock varies with strength of inducing field, type, composition, and amount of ferrimagnetic minerals, grain size, fabric, temperature, and pressure. The remanent magnetization of rocks depends on the quantity and composition of their ferrimagnetic minerals, their previous history in terms of time, heat, pressure, and the chemical environment to which they have been exposed since their formation; the types and various effects are summarized.—G.D.C.

Linger, Fay I. *See* Enbysk, Betty J. 7674

7611 **Lipps, Jere Henry.** Cenozoic planktonic Foraminifera—1, Wall structure, classification and phylogeny of genera; 2, California mid-Cenozoic biostratigraphy and zoogeography [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, p. 210B–211B, table, 1966.

7483 **Littlefield, W. M.** Hydrology and physiography of the Salton Sea, California: U.S. Geol. Survey Hydrol. Inv. Atlas HA–222, scale 1:125,000, text, 1966.

The Salton Sea occupies parts of Imperial and Riverside Counties, and lies below sea level 125 mi northeast of the Gulf of California; the two bodies of water are separated by the Colorado River delta. In the geologic past the sea was a part of the Gulf of California, and the Colorado River discharged alternately into the Gulf and the sea. The sea bed was a dry lake until irrigation was started in 1901 in the Imperial Valley; Colorado River floods increased its depth and volume until 1907 when water surface reached its maximum level, 195.9 feet below sea level. Since 1907 the water level has gradually receded as evaporation greatly exceeded inflow. Inflow occurs as rain and surface and ground water flow; the latter is about 50,000 acre feet per yr. In 1962 salinity of the sea was 34,000 ppm.—M.C.M.

7256 **Lloyd, G. V.** Exploration for gas in eastern Canada [abs.]: Oilweek, v. 17, no. 30, p. 42, 1966.

7559 **Lo, Kwan Yee.** Stability of slopes in anisotropic soils—Closure [to discussion of paper 4405, 1965]: Am. Soc. Civil Engineers Proc., v. 92, Jour. Soil Mechanics and Found. Div., no. SM 4, p. 77–82, illus., tables, 1966.

A distinction between inherent anisotropy of a soil and its stress anisotropy is necessary. Each sample extracted from the ground is subjected to a negative pore pressure; therefore, the initial effective stress is isotropic and the stress anisotropy is no longer present. It is now clear that intrinsic anisotropy is a physical fact rather than an assumption; it has been supported by test data of unconfined compression tests, tabulated here. The clay used was from the same site as that reported in the original paper. The dependence of pore pressure on strain at failure is an intrinsic behavior of anisotropic soils and not a result of the initial stress system. A third type of anisotropy may be "induced" during deformation, when shear strains tend to aline the particles. The vane test measures the over-all effects of intrinsic and stress anisotropy; as the degree of anisotropy increases, the potential failure surface will depart from the cylindrical form.—G.D.C.

7525 **Lochman, Christina.** Lower Ordovician (Arenig) faunas from the Williston Basin, Montana and North Dakota: Jour. Paleontology, v. 40, no. 3, p. 512–548, illus., 1966.

Cores from subsurface Deadwood Formation contain faunas of Arenig age, trilobite Zone E and G, with position of Zone F marked by unfossiliferous sandstone. Gastropod steinkerns predominate, inarticulate brachiopods are common, trilobites are fragmentary and rare, and the gastropod *"Lytospira" ornata* n. sp. and the scolecodont *Dentinella primaeva* n. gen. et sp. are new in Zone E. Zone G has typical trilobite–brachiopod assemblage with few gastropods. New trilobite taxa are *Aulacoparia (Praecoparia) wibauxensis* n. sp., *Aulacoparia (Aulacoparina) impressa* n. sp., *Ptyocephalus montanensis* n. sp., *Oculomagnus obreptus* n. gen. n. sp., *Peltabellia willistoni* n. sp., *Reubenella rex* n. gen. n. sp., *Strigigenalis amerada, and Lloydia (Leiostegium) valmyensis* n. sp.—R.E.G.

7578 **Lokke, Donald H.; VanSant, Jan F.** Upper Pennsylvanian Charophyta from Kansas: Jour. Paleontology, v. 40, no. 4, p. 971–974, illus., 1966.

"Gyrogonite variation is defined for *Stomochara morevi* (Peck) recovered from the King Hill Shale Member of the Lecompton Limestone (Virgilian) at two localities 37 miles apart in Douglas and Osage Counties, Kansas."—J.F.M.

7714 **Loofbourow, R. L.** Depth and rock temperatures: Mining Eng., v. 18, no. 1, p. 82–87, illus., tables, 1966.

It is estimated that rock temperatures range from 75°F to 200°F at 5,000 ft depth. Rock temperatures not directly measured can be estimated by correlating the nature and condition of a particular rock at a site with known gradients in similar rock elsewhere. The product of this thermal gradient and the depth of the rock is added to the mean annual surface temperature. Two maps show the distribution of expected high and low rock temperatures in the United States.—C.B.D.

Louis, M. C. *See* Hobson, G. D. 7459

Lounsbury, Richard E. *See* Marsh, Owen T. 7311

Lounsbury, Richard E. *See* Marcher, Melvin V. 7634

Lovell, Howard. *See* Ramsden, John. 7410

7496 **Lovell, Howard.** Black township, District of Timiskaming: Ontario Dept. Mines Prelim. Geol. Map P.328, scale 1 in. to 1/4 mi., text, 1966.

Black township lies between the Larder Lake and Porcupine Destor faults in the broad belt of predominantly volcanic rocks of northeastern Ontario and northwestern Quebec; rock types are Precambrian and are characteristic of the belt; most of the overburden is sand and boulder till. The most prominent structure is a syncline whose axis plunges approximately ESE from the northern part of the township; most of the lower strata are andesite and basalt; upper strata are dacite and rhyolite flows and agglomerates. Most exploration has been in search of gold and associated silver, copper, zinc, and lead. Sand and gravel are abundant. M.C.M.

7498 **Lovell, Howard.** Tolstoi township, District of Timiskaming: Ontario Dept. Mines Prelim. Geol. Map P.327, scale 1 in. to 1/4 mi., text, 1966.

All bedrock in Tolstoi township is Precambrian. From oldest to youngest, rock types are: mafic volcanic flows, coarse-grained mafic volcanic flows (or sills of mafic intrusive rocks), part of the Watabeag Lake batholith of silicic intrusive rocks, mafic intrusive dikes, and sedimentary rocks of the Cobalt Group. The western part of the township is a sand plain with few outcrops. The most prominent structure is a lineament that strikes northeast and can be traced for eight miles. A long, narrow magnetic anomaly corresponds approximately to the area of Cobalt sedimentary rocks. Most favorable areas for prospecting are those occupied by mafic intrusive and volcanic rocks.—M.C.M.

7499 **Lovell, Howard.** Benoit township, District of Timiskaming: Ontario Dept. Mines Prelim. Geol. Map P.329, scale 1 in. to 1/4 mi., text, 1966.

Benoit township lies between the Larder Lake and Porcupine–Destor faults, in the broad belt of predominantly volcanic rocks of northeastern Ontario and northwestern Quebec; rocks are Precambrian and characteristic of the belt. Clay covers most of the eastern and central parts, and a glaciofluvial sand plain covers the western part. The most prominent structural feature is a syncline, the axis of which plunges approximately southeast from the northwestern corner; most of its lower strata are andesite and basalt whereas the upper strata are dacite and rhyolite. Sand and gravel are abundant in the western part, and zinc, copper, lead, nickel, and asbestos are present in small amounts at several localities. No metal has been mined at a profit.—M.C.M.

Ludwick, John C. *See* Levinson, A. A. 7426

Luther, Edward T. *See* Swingle, George D. 7637

7563 **Lynch, Dean W.** The economic geology of the Esperanza mine and vicinity, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 267–279, illus., 1966.

The Esperanza copper–molybdenum deposit is in the Pima district, Arizona. Rock types described from the area are welded tuffs, four types of porphyry, granodiorite, and quartz diorite. The igneous rocks were intruded and extruded in a number of individual pulses. All rock types contain sulfides in varying amounts. Strong hydrothermal alteration persisted throughout the area, and potash metasomatism is a distinctive feature. The most prominent structural features are faults, which acted as conduits for ascending hypogene solutions and descending enriched solutions.—E.S.L.

Lynch, J. *See* Boyle, R. W. 7589

7332 **MacDonald, Gordon J. F.** Geodetic data, Sec. 10 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 219–221, tables, 1966.

Brief summaries are tabulated for: (1) the figure of the Earth's surface; (2) gravity at the surface, mass, density; (3) rotation; (4) moments of inertia; and (5) external gravitational potential.—G.D.C.

7284 **Macdonald, J. R.** The Barstovian Camp Creek fauna from Elko County, Nevada: Los Angeles County Mus. Contr. Sci., no. 92, 18 p., illus., tables, 1966.

The late Miocene Camp Creek fauna from the Raine Ranch formation in Elko County, Nevada, is described. The fauna includes Canids, Felids, Gomphotheriids, Equids, Camelids, and Cervids which are not determinate at the generic level. In addition there is *Parahippus sp., Protohippus sp., ?Brachycrus sp., Hesperocamelus stylodon, Aepycamelus sp., and ?Merycodus sp.* The degree of hypsodonty in the cranium of a juvenile *Protohippus* sp. suggests a post–Sheep Creek and pre–Barstow age for the fauna.—Author's abstract

7440 **MacGregor, D. C.; Owens, B.** Illustrations of Canadian fossils—Devonian spores of eastern and northern Canada: Canada Geol. Survey Paper 66–30, 66 p., illus., 1966.

This report, twelfth in the series, illustrates assemblages of miospores from Devonian rocks of Gaspé Peninsula, southern Ontario, southern District of Mackenzie, and the Parry Islands. Nine assemblages are shown, ranging in age from Gedinnian to Famennian. Each plate is accompanied by provisional taxonomic identifications and a brief statement of geographic and stratigraphic provenance of the fossils. Most of the fossils have not been figured previously.—*from* Authors' abstract

MacLaren, A. S. *See* Kornik, L. J. 7454

7480 **Major, Robert L.** Mineral resources and mineral industries of extreme southern Illinois region: Illinois Geol. Survey Mineral Economics Brief 13, 26 p., illus., tables, 1966.

The extreme southern Illinois region includes Alexander, Hardin, Johnson, Massac, Pope, Pulaski, and Union Counties. Although the region's mineral industries produced only 21 million dollars worth of goods, or 3.4 percent of the state total, their contribution to the economy of the region is significant. The area is the leading producer of fluorspar in the United States. Lead and zinc concentrates are produced as co products with fluorspar. Other mineral materials include crushed and broken limestone, cement, sand and gravel, silica, ganister, processed clay, and dimension stone. No petroleum has been discovered and coal production has been sporadic.—*from* Author's abstract

Manger, G. Edward. *See* Daly, R. A. 7326

Marchant, L. C. *See* Hamke, J. R. 7433

Marcher, Melvin V. *See* Marsh, Owen T. 7308

7309 **Marcher, Melvin V.; Marsh, Owen T.** Geologic map of the McEwen quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 39 SW, scale 1:24,000, separate text, 1966.

The accompanying text, "Mineral resources summary of the McEwen quadrangle, Tennessee," by L. T. Larson is cited separately.—M.C.M.

7634 **Marcher, Melvin V.; Lounsbury, Richard E.** Geologic map of the Summertown quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 51 NE, scale 1:24,000, separate text, 1966.

The accompanying text "Mineral resources summary of the Summertown quadrangle, Tennessee" by L. T. Larson is cited separately.—M.C.M.

7362 **Mardirosian, Charles A.** (compiler). Mining districts and mineral deposits of Utah, with production and gross value of the larger metal mining districts (excluding uranium districts): Salt Lake City, Utah, privately printed, scale 1:750,000, 1966.

7356 **Markas, John M.** Subsurface geology of northern McClain County, Oklahoma: Shale Shaker, v. 16, no. 9, p. 198–213, illus., table, 1966.

A comparative stratigraphic study of the pre Virgilian formations adjacent to the McClain County fault zone is made by means of well cores, well samples, electric logs, and structure contour and isopach maps. Ordovician to Permian strata are discussed, and three contour maps and three cross sections included. The geologic history and history of petroleum development are reviewed, and production information tabulated.—E.S.L.

7308 **Marsh, Owen T.; Marcher, Melvin V.** Geologic map of the Cumberland Furnace quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 302 SE, scale 1:24,000, separate text, 1966.

The accompanying text, "Mineral resources summary of the Cumberland Furnace quadrangle, Tennessee," by L. T. Larson is cited separately.—M.C.M.

Marsh, Owen T. *See* Marcher, Melvin V. 7309

7311 **Marsh, Owen T.; Lounsbury, Richard E.** Geologic map of the Pleasant View quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 304 NE, scale 1:24,000, separate text, 1966.

The accompanying text, "Mineral resources summary of the Pleasant View quadrangle, Tennessee," by L. T. Larson is cited separately.—M.C.M.

7377 **Marsh, Owen T.** Geology of Escambia and Santa Rosa Counties, western Florida Panhandle: Florida Geol. Survey Bull. 46, 140 p., illus., tables, 1966.

Formations of a thick sedimentary sequence of Eocene to Miocene age, underlying the western part of the Florida Panhandle, are described. Overlying them

unconformably is the Citronelle Formation of Pleistocene? age, capped by three surfaces of marine terrace deposits. A simple homocline dips southwestward at 30 to 40 feet per mile, without folds or faults except where the step faulted Pollard graben extends into the area from the north. Repeated movement from Late Cretaceous to Oligocene time has caused thickening of beds in the downthrown blocks, the throw increasing with depth. The nature of faulting, proximity of the Mississippi interior salt dome basin, and negative gravity anomalies support a theory of crustal collapse from flowage of salt at great depths. Ground water is abundant, the softest and least mineralized in Florida.—G.D.C.

7492 **Marsh, Owen T.; Laney, R. L.** Reconnaissance of the ground water resources in the Waynesville area, North Carolina: North Carolina Dept. Water Resources Ground Water Bull. 8, 131 p., illus., tables, 1966.

The Waynesville area lies in the Blue Ridge province, and is underlain by metamorphic rocks, mostly Precambrian. The 10 rock types mapped are described. Structurally the area is a northeast trending synclinorium, and no evidence is found for extending the Greenbrier thrust into the area. Nearly all wells get their water from bedrock fractures or other openings; granite gneiss B is the most productive. Information is summarized by counties. Chemical quality was determined from 67 analyses, and five different ground water types are discussed. Data were also collected from 93 springs. Records of both wells and springs are tabulated.—E.S.L.

Marshall, B. V. *See* Lachenbruch, A. H. 7400

7257 **Martin, Rudolf.** Exploration for natural gas: Oilweek, v. 17, no. 30, p. 31, 1966.

This keynote address at the ASPG/CSEG conference in Sept. 1966, reviews the significant differences between exploration for natural gas and for petroleum. The source rocks are often different, and gas migrates differently. Gas reserves in place show an approximately linear increase with depth.—E.S.L.

7584 **Massalski, T. B.; Park, F. R.; Vassamillet, L. F.** Speculations about plessite: Geochim. et Cosmochim. Acta, v. 30, no. 7, p. 649–662, illus., tables, 1966.

Plessite, a component of most metallic meteorites, is discussed in terms of its composition and texture. The variations in texture and composition indicate that more than one mechanism may be responsible for plessite formation. Without an unambiguous origin for plessite, interpretation of the compositional variations within plessite in terms of the thermal history of the meteorite can only be tentative.—Authors' abstract

Matsumoto, Hatao. *See* Yagi, Kenzo, 7448

7432 **Matthews, Barry.** Radiocarbon dated postglacial land uplift in northern Ungava, Canada: Nature, v. 211, no. 5054, p. 1164–1166, illus., table, 1966.

A provisional uplift curve, for which ages are plotted against altitude, is constructed on the basis of 10 radiocarbon dates of shells from raised marine terraces in northern Ungava, Quebec. The rate of uplift was initially rapid (about 20 feet per century between 7,700 and 6,700 years ago), then decreased, and for the past 4,000 years appears to have been just less than 1 ft per century; if, however, there was a marine transgression during formation of the lowest marine terraces, for which there is some evidence, the rate may have been between 1.5 and 3 feet per century, similar to that postulated for the Hudson Bay area.—D.B.V.

7510 **Matthews, Robert A.** Geology of the area between Clough Cave and Boyden Cave, Sequoia and Kings Canyon National Park area, California, *in* Caves of the Sequoia region, California: Natl. Speleol. Soc. Guidebook 7, p. 13–17, 1966.

Granitic rock, comprising 70 percent of the bedrock, has intruded metamorphic rocks, some of which remain as roof pendants. Both types of rock are described. The western slope of the Sierra Nevada is highly dissected by deeply entrenched streams, separated by plateau like steps reflecting the history of uplift. Glaciation was confined to valley glaciers, and the features are described.—E.S.L.

7642 **Matthews, Robert A.; Burnett, John L.** Geologic map of California, Olaf P. Jenkins edition—Fresno sheet: [San Francisco] California Div. Mines and Geology, scale 1:250,000, separate explanatory sheet, 1966.

The explanatory sheet includes an index to geologic mapping used in compilation of the Fresno sheet, a stratigraphic nomenclature chart, topographic quadrangles within the Fresno sheet available from the U.S. Geological Survey, and illustrations.—M.C.M.

7576 **Maughan, Edwin K.** Environment of deposition of Permian salt in the Williston and Alliance basins, *in* Symposium on salt, 2d—V. 1, Geology, geochemistry, mining: Cleveland, Ohio, Northern Ohio Geol. Soc., p. 35–47, illus., 1966.

Evaporites, including halite, were deposited on the craton in the northern mid continent region during Permian time; paleomagnetic data suggest that the region lay between 0° and 10° N. paleolatitude and the climate was probably warm. Little moisture was contributed by the Phosphoria sea, lying not far to the west. The ancestral Rocky Mountain system further isolated the low lying craton from the Phosphoria sea, except in central Wyoming where a transverse trough permitted flooding from the west. Thick deposits of halite formed over a wide area in the Williston basin in western North Dakota and immediately adjacent parts of Montana and South Dakota. Much thinner halite deposits formed in the smaller Alliance basin in western Nebraska and adjacent parts of Wyoming.—*from* Author's abstract

Mavis, Frederic T. *See* Neill, Charles R. 7556

Maxwell, J. A. *See* Eade, K. E. 7682

7693 **Maynes, A. D.** A semi-micro procedure for mineral analysis: Chem. Geology, v. 1, no. 1, p. 61–75, tables, 1966.

A semi-micro procedure for mineral analysis based on ion exchange and complex-ion formation is described. Moisture (H_2O^-), SiO_2, TiO_2, Al_2O_3, total iron, CaO, MgO and either Mno or P_2O_5 are determined in a 100-mg sample. If MnO is present at low concentration, both MnO and P_2O_5 may be determined. K_2O and Na_2O may be determined in a 2-mg sample. Procedures for the determination of FeO and H_2O^+ in 100-mg samples have not been tested. It is estimated that 6 samples or more may be analyzed in 7 days.—Author's abstract

McCary, Charles E. L. *See* Wilson, Charles W., Jr. 7635

McCary, Charles E. L. *See* Hershey, Robert E. 7687

McCrady, Allen D. *See* Guilday, John E. 7582

7707 **McDougall, David J.** A study of the distribution of thermoluminescence around an ore deposit: Econ. Geology, v. 61, no. 6, p. 1090–1103, illus., table, 1966.

There are so many possible causes of thermoluminescence besides radioactive history that a variety of patterns may be found in the vicinity of ore deposits. At the Whalesback copper deposit, Springdale, Newfoundland, in altered volcanic rocks, "the intensity and/or width [up to 200 feet] of the zone of anomalous thermoluminescence appears to be related to the amount of chalcopyrite mineralization but does not appear to have any direct relationship to the pyrite and pyrrhotite mineralization." Though not universally applicable, thermoluminescence should commonly have value as an exploration tool.—W.S.W.

7303 **McGinnis, Lyle D.** Gravity base station network in Illinois: Illinois Geol. Survey Circ. 398, 18 p., illus., tables, 1966.

A gravity base station network comprising 29 stations has been established with a LaCoste and Romberg gravity meter in Illinois. The stations are tied to a pendulum base at Washington University, St. Louis, Mo., having a value of 979.99863 gals. From a series of adjusted loops, the observed gravity value at the

Champaign–Urbana, Illinois, base (Station 17) was found to be 980.12905 gals. All stations in the network are tied to within ±0.1 milligals of the St. Louis base.—Author's abstract

McIlhargey, J. M. *See* Flock, D. L. 7259

McManus, Dean A. *See* Creager, Joe S. 7406

7507 **Meade, Robert H.** Salinity variations in the Connecticut River: Water Resources Research, v. 2, no. 3, p. 567–579, illus., 1966.

Salinity distributions in the lower Connecticut River measured during the years 1934 through 1939 show the influence of river discharge, tide, and wind. Salinity near the mouth is rather sensitive to changes in upland discharge. During average or greater than average discharge conditions, the lower river has the characteristics of a 'salt wedge' estuary. At high tide, water on the bottom of the river may contain 15 parts of chloride per thousand, whereas at low tide it may be almost completely fresh.—E.S.L.

7488 **Metcalf, Artie L.** Fishes of the Kansas River system in relation to zoogeography of the Great Plains: Kansas Univ. Mus. Nat. History Pub., v. 17, no. 3, p. 23–189, illus., tables, 1966.

The formations and geomorphology of the area are discussed in relation to species of fish in the streams. The occurrence of some is best explained in terms of preglacial drainage patterns, of which three systems are described. From Pliocene fossil evidence and present distributions, the species contributed by each system are listed. Mingling of stocks resulted from disruption and diversions of Pleistocene drainages.—E.S.L.

Metz, Harry E. *See* Bryant, Donald G. 7570

7569 **Metz, Robert A.; Rose, Arthur W.** Geology of the Ray copper deposit, Ray, Arizona, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 176–188, illus., geol. map, 1966.

The varied geologic events and processes that have taken place at Ray give it some features that appear to be unique. One is the irregularity of the quartz monzonite intrusives, and the fact that they contain so small a part of the orebody. The largest outcrops of the Granite Mtn. Porphyry occur outside the district and are barren. Another singular feature is the importance of diabase over any other host rock. Factors related to the formation of copper silicates east of the Diabase fault are unusual. The importance of old recurrently active structures, the genetic relation of ore to the porphyry, and the necessity of supergene enrichment to making mining practicable, are analogous to other deposits. A detailed discussion of alteration derived from mineralogic studies is given.—E.S.L.

Meyer, Thomas O. *See* Emerson, David E. 7482

7438 **Middleton, Gerard V.** Experiments on density and turbidity currents—[Pt.] 1, Motion of the head: Canadian Jour. Earth Sci., v. 3, no. 4, p. 523–546, illus., tables, 1966.

Two series of experiments were performed in a flume. In the first, saline density currents were formed by pumping salt solutions at constant discharge into the tilted flume. In the second, the flume was horizontal and turbidity currents were formed by releasing suspensions of plastic beads at one end. In both series, a characteristic head was formed at the front of the flow. It was found that the motion of this head was closely described by Keulegan's laws for saline surges, and it is concluded that certain aspects of the motion of turbidity current heads can be investigated by experiments on density currents formed from clay suspensions or salt solutions. The velocity of density (by inference, turbidity) current heads on slopes up to four percent is adequately expressed by a formula of Keulegan's which is greatly different from the Chézy equation previously used for analysis of turbidity-current movements.—E.S.L.

7709 **Middleton, Gerard V.** Experiments on density and turbidity currents—[Pt.] 2, Uniform flow of density currents [with French abs.]: Canadian Jour. Earth Sci., v. 3, no. 5, p. 627–637, illus., table, 1966.

The basic theory for the average velocity of uniform flow of a density current is now well established. The resistance at the bottom may be estimated from reasonable assumptions regarding the roughness of the bottom and the size of the current. The principal problem remaining is quantitative estimation of the resistance of the upper (fluid) interface. A review of the literature suggests that this resistance increases with increase in Froude number and decreases with increase in Reynolds number, and the writer's experiments support this hypothesis. As many turbidity currents are large scale and flow over low slopes of relatively small roughness it seems probable that both the bottom resistance and the resistance at the upper interface are small.—Author's abstract

7597 **Mielenz, Richard C.** Concrete aggregates—Petrographic examination, *in* Significance of tests and properties of concrete and concrete making materials: Am. Soc. Testing and Materials Spec. Tech. Pub. 169-A, p. 381–403, illus., tables, revised 1966; originally published 1956.

This paper summarizes the objectives and applications of petrographic examination with reference to gravel, sand, crushed stone, slag, and common lightweight aggregates. Techniques are treated very briefly. Examples of tabulation of analyses are given. Examination both in the field and in the laboratory is discussed. In the field, such examination aids in exploration, sampling, and evaluation, and in the laboratory it supplements the standard acceptance tests.—E.S.L.

Miller, Robert A. *See* Wilson, Charles W., Jr. 7310

Miller, Robert A. *See* Swingle, George D. 7637

7638 **Miller, Robert A.; Hardeman, William D.; Fullerton, Donald S.; Sykes, C. Ronald; Garman, R. Keith.** (compilers and editors). Geologic map of Tennessee—West-central sheet: Nashville, Tennessee Div. Geology, scale 1:250,000, 1966.

7639 **Miller, Robert A.; Hardeman, William D.; Fullerton, Donald S.** (compilers and editors). Geologic map of Tennessee—West sheet: Nashville, Tennessee Div. Geology, scale 1:250,000, 1966.

Miller, Robert A. *See* Swingle, George D. 7640

7262 **Milne, J. F.** Gas reservoirs in the Hesketh Ghost Pine area of Alberta [abs.]: Oilweek, v. 17, no. 30, p. 34, 1966.

7504 **Milne, V. G.** Black River area, District of Thunder Bay: Ontario Dept. Mines Prelim. Geol. Maps P.332–335, 4 sheets, scale 1 in. to 1/2 mi., text, 1966.

The northern half and western parts of the Black River area are underlain by granite gneisses and younger massive granitic rocks intruding these gneisses. To the southeast rocks consist of a folded series of paragneisses, conglomerates, and hornblende intruded by serpentinite, metagabbro, and granitic rocks. Youngest rocks appear to be diabases which form dikes. The metasedimentary metavolcanic belt of rocks represents the southern limb of a roughly ENE trending anticlinorium. Traces of mineralization have been found in several localities and continuing investigations are being made in anomalous areas. Maps 332–335 show the northwest, northeast, southwest, and southeast parts of the area, respectively.—M.C.M.

Milton, Charles. *See* Smith, John Ward, 7657

Minard, James P. *See* Owens, James P. 7317

7612 **Monty, Claude Leopold Victor.** Geological and environmental significance of Cyanophyta [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, p. 211B, 1966.

Moody-Stuart, Judith. *See* Hughes, N. F. 7232

7529 **Moolick, R. T.; Durek, J. J.** The Morenci district, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 221–231, illus., tables, 1966.

The Morenci district, Arizona, was discovered in 1872, and in early 1964 copper ore was being mined at the rate of 60,000 tons a day. The orebody was formed by supergene enrichment of a disseminated pyrite–chalcopyrite protore in quartz monzonite porphyry. The Laramide stock was intruded into the Precambrian basement complex and Paleozoic–Mesozoic sedimentary rocks, along a Precambrian zone of weakness. The intrusive consists of diorite, quartz monzonite, and granite porphyry occurring in progressively more acid phases that are age related. Only the younger two are mineralized. The enrichment blanket was formed in the Tertiary, before volcanism and northwest faulting.—E.S.L.

7405 **Moore, George W.** Arctic beach sedimentation, Chap. 22 *in* Environment of the Cape Thompson region, Alaska: U.S. Atomic Energy Comm. Rept. PNE-481, p. 587–608, illus., 1966.

Permanent beach-ridge plains are forming along the northwestern coast of Alaska, where a change in direction decelerates the rate of alongshore transport, and all incoming sediment is not moved. Along the rest of the coast, beach sediments form a prism about 100 m wide and up to 6 m thick near the shoreline. In the Fall a rampart of ice and gravel, a kaimoo, forms protecting beach sediment from disruption by sea ice. A derived formula showing relation between rate of alongshore transport, wave height, and surf angle indicates that rate of transport varies greatly. Investigation of a large permanent spit shows that about 22,000 m^3 of sediment a year has moved southeastward past each point in the study area during recent centuries.—E.S.L.

Morgridge, Dean L. *See* Laudon, Lowell R. 7699

7681 **Morris, William J.** Fossil mammals from Baja California—New evidence on Early Tertiary migrations: Science, v. 153, no. 3742, p. 1376–1378, illus., 1966.

Ungulates of the family Barylambdidae (Amblypoda) were found above remains of Tillodontia and *Hyracotherium* (Equidae) within a geologic unit in Baja California; the expected order, from lowest to highest, would be Barylambdidae, Tillodontia, *Hyracotherium*. The assemblage is assigned to the late Paleocene. D.B.V.

Mrose, Mary E. *See* Evans, Howard T., Jr. 7358

7647 **Muecke, G. K.; Charlesworth, H. A. K.** Jointing in folded Cardium sandstones along the Bow River, Alberta: Canadian Jour. Earth Sci., v. 3, no. 5, p. 579–595, illus., table, 1966.

Five thousand joints were examined in gently folded sandstones of the Cretaceous Cardium Formation, and 20 domains, based on homogeneity of bedding and joint orientation, were established. Geometric analysis shows that joint sets from all domains fall into four classes, all normal to bedding. Pole diagrams for each domain and bedding poles are shown, and the domains tabulated. Dynamic analysis of jointing divides joint sets into two conjugate-shear, and two extension sets. Orientation of the stress system was apparently different at the time of J_1 jointing from that of the other three. Magnitude of the orogenic stress system decreased eastwards. The tectonic history is summarized.—E.S.L.

7306 **Mueller, Harry W., 3d.** Deformational variation across strike in the Mississippian sandstone–shale sequence of the southernmost Appalachians: Alabama Acad. Sci. Jour., v. 37, no. 2, p. 158–162, illus., 1966.

In the vicinity of Birmingham, Ala., the Mississippian sandstone–shale sequence crops out in three belts following the trend of the Appalachians, and in a small belt trending perpendicular to the others and connecting two of them. The Talladega

Slate to the southeast might be considered a fifth belt. The repetition is due to folding and thrusting. The structural geology of these belts is compared, with emphasis on degree of deformation, which increases to the southeast. It appears that the primary force must have come from the southeast and diminished to the northwest.—E.S.L.

7276 **Müller, O.** Potassium analysis, *in* Potassium argon dating: New York, Springer-Verlag, p. 40–67, illus., tables, 1966.

Brief discussions are given of the physical and chemical properties of potassium and its isotopes, and their terrestrial and extraterrestrial abundance. The chemical methods of separation and determination are treated under precipitation reactions and gravimetric techniques, ion exchange chromatography, and flame photometry, and physical methods under X-ray fluorescence, mass spectrometric isotope dilution, and neutron activation. Applications of these methods to terrestrial material, tektites, and meteorites, both stony and iron, conclude the paper.—E.S.L.

7654 **Murphy, James L.** The Pennsylvanian pelecypod genus *Palaeoneilo* Hall and Whitfield: Jour. Paleontology, v. 40, no. 4, p. 867–876, illus., 1966.

A reevaluation of the Pennsylvanian nuculoid pelecypod genus *Anthraconeilo* Girty (1911) reveals that it is a junior synonym of *Palaeoneilo* Hall and Whitfield, 1869. Girty's type species, *A. taffiana*, *Yoldia carbonaria* Meek, and *Y. knoxensis* McChesney are all considered to be synonyms of *Y.? oweni* McChesney. Two species referred to *Anthraconeilo* by Morningstar (1922) are also discussed, although material suitable for an adequate reappraisal is wanting. The genus *Palaeoneilo*, not previously considered to be a typical representative of Pennsylvanian pelecypod biota, is found to be common in the marine zones of the Pennsylvanian System.—Author's abstract

7587 **Mutch, Thomas A.** Abundances of magnetic spherules in Silurian and Permian salt samples: Earth and Planetary Sci. Letters, v. 1, no. 5, p. 325–329, illus., table, 1966.

Abundances of magnetic spherules in 10 Silurian samples from a Michigan mine and 16 Permian samples from Kansas and New Mexico mines, are very similar to abundances in recent collections from the atmosphere. This suggests that meteoritic influx has been constant for the three periods of time sampled.—Author's abstract

Nafe, J. E. *See* Sheridan, R. E. 7694

Nagy, Bartholomew. *See* O'Sullivan, Thomas D. 7712

7478 **Naidu, P. S.** Apparent resistivity over a thin dipping dyke: Geoexploration, v. 4, no. 1, p. 25–36, illus., 1966.

Apparent resistivity over a thin dipping dyke, which is buried under the surface at a unit depth, has been theoretically investigated. The method of Schwarz-Christoffel transformation has been used to solve the boundary-value problem. A series of apparent resistivity curves for different angles of inclination and electrode separations are presented. These curves are believed to illustrate the characteristics of the anomaly.—Author's summary.

Nakamura, Koji. *See* Hashimoto, Seiji, 7437

7556 **Neill, Charles R.; VanDerGiessen, N.; Blench, Thomas; Mavis, Frederic T.; Laushey, Louis M.** Sediment transportation mechanics—Initiation of motion—Discussion [of paper 4738, 1966]: Am. Soc. Civil Engineers Proc., v. 92, Jour. Hydraulics Div., no. HY 5, p. 280–291, illus., 1966.

Neill and Van Der Giessen confine their discussion of this paper, by the Task Comm. on Preparation of Sedimentation Manual, to noncohesive sediment on a flat bed. The first part deals with available design data, the second with dimensional analysis, and the third suggests a scheme for correlating experimental data that does not

seem to have been considered previously in the literature. Blench lists amendments and additions that cannot be explained and documented in a short discussion, but refers to his "mobile bed fluviology" (1966). Mavis and Laushey present a diagram showing the outline of physical variables related to competence and loads.—G.D.C.

Neill, Charles R. *See* Ben Zvi, A. 7557

7629 **Nelson, C. A.** Geologic map of the Blanco Mountain quadrangle, Inyo and Mono Counties, California: U.S. Geol. Survey Geol. Quad. Map GQ-529, scale 1:62,500, sections, 1966.

7380 **Nelson, J. G.; Ashwell, I. Y.; Brunger, A. G.** Recession of the Drummond Glacier, Alberta: Canadian Geographer, v. 10, no. 2, p. 71–81, illus., tables, 1966.

The Drummond Glacier, located in Banff National Park, provides the first details on recession in the eastern ranges of the Canadian Rockies. The photographic record from 1884 to the present is described and illustrated. Data from Saskatchewan and Freshfield Glaciers are compared with that from Drummond. Recession estimates are based on dendrochronological and C-14 evidence, and recent measures of recession and vertical ablation. The annual amount of recession of the glacier was highest in 1930–39, 124 feet, and in 1964–65 was 27 feet.—E.S.L.

7372 **Neumann, Gerhard; Pierson, Willard J., Jr.** Principles of physical oceanography: Englewood Cliffs, N. J., Prentice-Hall, 545 p., illus., tables, 1966.

This textbook is intended primarily for undergraduate students at the senior level and beginning graduate students in geophysics specializing in oceanography and meteorology. It also may be a reference text for geophysicists, and for scientists and engineers from other disciplines. The final aim is to point out areas of current controversy and unsolved problems in oceanography. That which is known and well established forms the major part of this book. Chapters of geologic interest include early exploration and development of oceanography, geomorphology of the ocean bottom, physical and chemical properties of sea water, ice, equipment and techniques, hydrodynamic equations, and discussions of currents.—G.D.C.

7354 **Newby, Jerry B.** Memorial of Howard E. Brown (1899–1963), science teacher: Shale Shaker, v. 16, no. 8, p. 188–189, portrait, 1966.

7555 **Nordin, Carl F., Jr.; Algert, James H.** Spectral analysis of sand waves: Am. Soc. Civil Engineers Proc., v. 92, paper 4910, Jour. Hydraulics Div., no. HY 5, p. 95–114, illus., tables, 1966.

The techniques of autocorrelation and spectral density analysis of random processes were applied to the problem of describing and predicting bed profiles of a sequence of dunes in sand-bed channels. The data analyzed were from three sources, a 0.4-ft wide flume, an 8-ft wide flume, and a conveyance channel of the Rio Grande near Bernardo, N. Mex. From the computed covariance and spectral density functions, it was determined that the process could be represented approximately by a Markov second-order linear model. The first three values of the covariance functions, which were found sufficient for computing the approximate models and two other parameters which describe the goodness of fit of the models, are shown to be functions of the simple flow parameter, unit discharge.—Authors' abstract

Nyland, E. *See* Goodacre, A. K. 7717

7623 **Oakeshott, Gordon B.** San Andreas fault—Geologic and earthquake history: California Div. Mines and Geology Mineral Inf. Service, v. 19, no. 10, p. 159–166, illus., 1966.

The San Andreas fault strikes about N. 35° W. and has a total length of 650 mi; earthquake activity along the fault since 1769 is reviewed. A linear depression has developed with features of a classic rift valley, fractures are en echelon, dominant movement is right lateral, and amount of displacement varies. In the Coast Ranges the fault has brought together two different types of rock, and understanding of these may reveal the pre-Tertiary history of the fault. Attempts to correlate

Cenozoic marine and volcanic rock units, deposited both east and west of the fault, indicate a total displacement from several hundred miles horizontal to ancient large vertical and small Cenozoic horizontal; creep is still taking place. Some unsolved problems are listed.—E.S.L.

7624 **Oakeshott, Gordon B.** Parkfield earthquakes, Monterey and San Luis Obispo Counties, California, June 27–29, 1966: California Div. Mines and Geology Mineral Inf. Service, v. 19, no. 9, p. 150–151, 156, illus., 1966.

Three moderately small earthquakes in the Parkfield–Cholame area, California, having Richter ratings of 5.0 to 5.5, were followed by several hundred aftershocks; damage was slight. The aftershock pattern shows a series of movements on the San Andreas fault zone for about 25 miles. Surface fractures followed the last active trace in the two-mile wide zone, and consisted of minor fractures arranged en echelon. Right-lateral movement of several inches was measured, and creep continues.—E.S.L.

7708 **Oakeshott, Gordon B.** Parkfield earthquakes of June 27–29, 1966, Monterey and San Luis Obispo Counties, California—Preliminary report, geologic features: Seismol. Soc. America Bull., v. 56, no. 4, p. 961–966, illus., 1966.

The epicentral region of the earthquakes that shook the Parkfield area in southern Monterey County, Calif., in June 1966 is on a known active segment of the San Andreas fault. The fault zone shows a braided pattern of branching en echelon major faults. Topographic forms typical of the features of rift valleys testify to the recency of fault movements.—D.B.V.

7302 **Oetking, Philip; Feray, Dan E.; Renfro, H. B.** (compilers). Geological highway map of the Mid-Continent region—Kansas, Oklahoma, Missouri, Arkansas: Am. Assoc. Petroleum Geologists U.S. Geol. Highway Map Ser., no. 1, scale 1:1,875,000, sections, text, 1966.

This is the first in a series of 11 regional maps being prepared to cover the contiguous states of the United States. The sheet includes a generalized chart of time and rock units, cross sections, physiographic and tectonic maps, a brief geological history of the area, and a mileage chart. Instructions are given for interpreting the map in terms of the stratigraphic charts.—M.C.M.

Okun, Daniel Alexander. *See* Fair, Gordon Maskew, 7379

Oles, Keith F. *See* Enlows, Harold E. 7700

7686 **Olive, Wilds W.** Geologic map of the Heath quadrangle, McCracken and Ballard Counties, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-561, scale 1:24,000, section, text, 1966.

Abundant fair- to good-quality water is obtained from sands of the Claiborne(?) and Wilcox Formations at depths of 40–200 feet, and from gravel of the continental deposits at depths of 30–100 feet. Clay from the Claiborne(?) and Wilcox has a potential value for ceramic use. Gravel for road metal and fill is periodically mined from several pits.—M.C.M.

7566 **Olmstead, Hugh W.; Johnson, David W.** Inspiration geology, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 143–150, illus., 1966.

The Inspiration copper mine, in the Miami district, Gila County, Ariz., has been mined since 1896. Precambrian schist and sedimentary rocks are intruded by several types of igneous rocks, of which the Schultze Granite (porphyritic quartz monzonite) and its granite porphyry phase, contain the orebody and are genetically related to it. Structural control by faults is discussed. As the original hypogene mineralization was of low tenor, the orebody is dependent on supergene enrichment.—E.S.L.

Omernik, John B. *See* Laudon, Lowell R. 7699

7230 **Ormiston, Allen R.** Occurrence of *Australosutura* (Trilobita) in the Mississippian of Oklahoma, U.S.A.: Palaeontology, v. 9, pt. 2, p. 270–273, illus., 1966.

A species of *Australosutura* is described from Mississippian rocks of northeastern Oklahoma, regarded as being Viséan in age. It is more like the earlier-described Australian species than that from Argentina. All specimens described here come from the Bayou Manard Member of the Moorehead Formation, Oklahoma. It is suggested that *Mystrocephala* Whittington (1960) is better qualified than *Cordania* as a possible ancestor of *Australosutura*.—G.D.C.

7712 **O'Sullivan, Thomas D.; Smith, Norman O.; Nagy, Bartholomew.** Solubility of natural gases in aqueous salt solutions—[Pt.] 3, Nitrogen in aqueous NaCl at high temperatures: Geochim. et Cosmochim. Acta, v. 30, no. 5, p. 617–619, tables, 1966.

Results are presented of preliminary measurements of the solubility of nitrogen in water and one-molal NaCl solutions at pressures up to 10,000 lb per sq in at 51.5°C and in one-molal NaCl solutions also at 102.5°C. The presence of NaCl reduces the solubility of nitrogen by about 25 percent at all pressures studied and at both temperatures.—D.B.V.

7715 **Otsuka, Michio.** Azimuth and slowness anomalies of seismic waves measured on the central California seismographic array—Pt. 2, Interpretation: Seismol. Soc. America Bull., v. 56, no. 3, p. 655–675, illus., table, 1966.

The azimuth and slowness anomalies for P-waves described in the first part (ibid., v. 56, no. 1, p. 223–229, 1966) are interpreted. The structural feature primarily responsible appears to be located in the upper mantle within a depth of the order of 100 km of the surface. If the anomalies are due to crustal thickening alone, a dip of the M-discontinuity as steep as 20° must be assumed. It is suggested that below a moderately dipping M-discontinuity there is a deeper interface, with a downward velocity decrease, which dips steeply toward the ocean. Traveltime anomalies of certain California stations are explained in terms of a regional structural trend, as an alternative to the hypothesis of Press and Biehler, 1964.—D.B.V.

Owens, B. *See* MacGregor, D. C. 7440

7317 **Owens, James P.; Minard, James P.** Pre-Quaternary geology of the Allentown quadrangle, New Jersey: U.S. Geol. Survey Geol. Quad. Map GQ-566, scale 1:24,000, 1966.

Pajaud, Daniel. *See* Termier, Geneviève. 7416

7258 **Pallister, A. E.** Application of seismic techniques to reef traps [abs.]: Oilweek, v. 17, no. 30, p. 34, 36, 1966.

Park, F. R. *See* Massalski, T. B. 7584

Parker, Ronald B. *See* King, John S. 7484

7315 **Patterson, Elmer D.** Geologic map of the Montaqua quadrangle, Carbon and Stillwater Counties, Montana: U.S. Geol. Survey Geol. Quad. Map GQ-580, scale 1:24,000, section, text, 1966.

The only coal in the Montaqua quadrangle is subbituminous, jet black, finely banded, and locally contains thin clay partings; it is in the basal part of the Eagle Sandstone and varies in thickness from one to five feet. Wells drilled for oil and gas were not completed as producers; most were in the Cloverly Formation (Cretaceous) but one was drilled to the Madison Limestone. Several producing fields in surrounding areas suggest that given proper traps oil or gas would be present in this quadrangle.—M.C.M.

7477 **Paul, Rodman W.** Clio and the rockhound—Or what happened when the muse of history learned all about geology: California Div. Mines and Geology Mineral Inf. Service, v. 19, no. 6, p. 87–93, illus., 1966.

In doing research for his book, *California Gold*, the author read a number of geologic papers published by state and federal surveys. He presents the geologic background for the gold, that explains why historical events happened as they did. This address was given at the Association of American State Geologists 58th annual meeting dinner.—E.S.L.

Peterman, Zell E. *See* Clark, Sydney P., Jr. 7346

7528 **Peters, W. C.; James, A. H.; Field, C. W.** Geology of the Bingham Canyon porphyry copper deposit, Utah, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 165–175, illus., tables, 1966.

The Bingham Canyon district is an outstanding example of a large zoned hydrothermal ore complex with local and regional structural control and with definite intrusive associations. Sulfide zoning is reflected in a central chalcopyrite–bornite–molybdenite association, grading into a peripheral chalcopyrite–pyrite association, and into a pyritic halo. Zonal relations are also apparent in vein and replacement deposits. A wide range of hydrothermal conditions is suggested by the variety of minerals. A common source for the fluids is suggested, with zoning governed by the chemistry of host rocks and hydrothermal fluids, as well as by temperature. The mineralized Bingham stock is characterized by intense fracturing, but the neighboring Last Chance stock is lacking in closely spaced fractures and is barren.—E.S.L.

7387 **Peterson, Gary L.** Structural interpretation of sandstone dikes, northwest Sacramento Valley, California: Geol. Soc. America Bull., v. 77, no. 8, p. 833–841, illus., 1966.

A swarm of approximately 150 sandstone dikes, individually up to eight feet wide and several miles long, cuts strata of the Budden Canyon Formation (Cretaceous) near Ono, Calif. The dikes are vertical or nearly vertical and most strike 45°–65° E. of the trends of right-lateral faults that cut basement rocks. Apexes of the acute angles between the two sets of structures point toward the direction of fault slip. This structural arrangement closely resembles experimentally produced deformation patterns and suggests that the dikes represent fillings of tension gashes (feather joints) developed in incompetent marine unit in response to strike-slip faulting in the underlying competent basement complex.—H.C.W.

7316 **Peterson, Warren L.** Geologic map of the Nelsonville quadrangle, central Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-564, scale 1:24,000, section, text, 1966.

Holes drilled for oil and gas in the Nelsonville quadrangle have not resulted in commercial production. The lower part of the shale member of the Borden Formation in adjacent quadrangles shows it to be suitable in places for brick, tile, and lightweight aggregate, and on the same basis there are possibilities for limestone also.—M.C.M.

Petro, J. H. *See* Holowaychuk, N. 7403

7389 **Pevear, David R.; Pilkey, Orrin H.** Phosphorite in Georgia continental shelf sediments: Geol. Soc. America Bull., v. 77, no. 8, p. 849–858, illus., 1966.

Rounded, polished phosphorite sand grains occur in continental shelf, beach, and estuarine sediments of the coast of Georgia. Both amber and black phosphorite are present and together average one percent of the total sediment. The grain size of the phosphorite and quartz fractions of most samples are similar, and in conjunction with the high polish on phosphorite grains indicate a probable detrital origin of the phosphorite. Since present-day rivers are not contributing phosphorite, it must have been derived from Pleistocene river sources or from outcropping phosphate-rich Miocene(?) sediments on the shelf. The presence of phosphorite in beach and estuarine sands requires that part of this sand be derived by landward transport of sediments from the continental shelf.—H.C.W.

7613 **Pickett, Thomas Ernest.** The modern sediments of Pamlico Sound, North Carolina [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, p. 212B, 1966.

7490 **Pierce, W. Dwight.** Fossil arthropods of California—[No.] 29, Silicified Miocene pupae of ceratopogonid flies: Southern California Acad. Sci. Bull., v. 65, no. 2, p. 81–98, illus., 1966.

These silicified Miocene insects are found imbedded in nodules, in lake beds, from mountain areas in California. Only a small part of the collected nodules have been studied. The pupae, in all stages of their week-long existence, are described and illustrated by drawings, and include 5 new genera and 15 new species.—E.S.L.

7319 **Pierce, William G.** Geologic map of the Cody quadrangle, Park County, Wyoming: U.S. Geol. Survey Geol. Quad. Map GQ-542, scale 1:62,500, sections, 1966.

Pierson, Willard J., Jr. *See* Neumann, Gerhard. 7372

Pilkey, Orrin H. *See* Pevear, David R. 7389

Pinson, W. H., Jr. *See* Fairbairn, H. W. 7453

7352 **Pojeta, John, Jr.** North American Ambonychiidae (Pelecypoda): Palaeontographica Americana, v. 5, no. 36, p. 131–241, illus., tables, 1966.

The purpose of the present work is to give a detailed account of the morphology and taxonomy of the poorly known early Paleozoic pelecypod family Ambonychiidae. An extensive generic restudy of the North American forms has been carried out, and the phylogeny of the family is considered. Ambonychiids are equivalved, inequilateral, byssate pelecypods which show morphological similarities to the Paleozoic families Myalinidae, Pterineidae, and Cyrtodontidae. Sixteen North American genera, from Middle Ordovician to Late Devonian in age, are herein regarded as belonging to the Ambonychiidae. *Byssonychia* Ulrich and five other generic names are not recognized as valid. One new genus *Maryonychia* is proposed.—*from* Author's abstract

7238 **Pollock, G. D.** Geology of the Trophy Lake area (west half), Granville Lake Mining Division, Manitoba: Manitoba Dept. Mines and Nat. Resources Mines Br. Pub. 64-1, 14 p., tables, geol. map, 1966.

The petrology and stratigraphy of the Precambrian rocks are discussed. Folding is the principal structural feature. No evidence of mineralization of economic importance was observed.—E.S.L.

7494 **Popenoe, Peter.** Aeroradioactivity survey and areal geology of parts of southeastern New York and southern New England (ARMS-I): U.S. Atomic Energy Comm. Civil Effects Study CEX 58.4.6, 31 p., illus., table, 1966.

Results of an airborne gamma-radiation survey of Connecticut, Rhode Island, and parts of New York, Massachusetts, New Hampshire, and Vermont indicate a wide range of natural radioactivity closely related to both bedrock and overlying glacial drift. This report discusses the southern part of the area; the northern part is discussed in CEX-59.4.41 (Popenoe, 1964). On the mainland radioactivity generally is relatable to bedrock as the glacial drift is of local derivation. Quincy Granite of Rhode Island has the highest radioactivity of any rock (1500 cps); higher than average radioactivity is found in other rocks in eastern Connecticut and Rhode Island. Rocks of lower than average radioactivity include those of the Cortlandt Complex, Housatonic and Berkshire Highlands, Glastonbury Gneiss, Plainfield Formation, and glacial deposits.—*from* Author's abstract

7331 **Press, Frank.** Seismic velocities, Sec. 9 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 195–218, illus., tables, 1966.

Due to the large range of velocities even for well defined materials, and the common overlapping of velocity ranges of different materials, a unique interpretation of

material distribution rarely can be made from seismic data alone. Sampling errors of as much as 10 percent for both laboratory and field determinations may occur. A compilation of seismic velocities serves to provide known ranges, and possible average values or typical ranges. A complete listing is not attempted, priority in selection being given to recent measurements on well described, common rocks. Field measurements are based on explosion waves of 10–100 cycles per second; laboratory determinations were made on small cylindrical samples.—G.D.C.

7614 **Ptacek, Anton Donald.** Cenozoic geology of the Seven Devils Mountains, Idaho [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, p. 212B, 1966.

7413 **Pye, E. G.** (compiler). Schreiber sheet, District of Thunder Bay: Ontario Dept. Mines Prelim. Geol. Map P.360, scale 1 in. to 2 mi., 1966.

7414 **Pye, E. G.** (compiler). Black Bay sheet, District of Thunder Bay: Ontario Dept. Mines Prelim. Geol. Map P.358, scale 1 in. to 2 mi., 1966.

7415 **Pye, E. G.** (compiler). Red Rock–Pine Portage sheet, District of Thunder Bay: Ontario Dept. Mines Prelim. Geol. Map P.357, scale 1 in. to 2 mi., 1966.

7585 **Quigley, R. M.; Dreimanis, A.** Secondary aragonite in a soil profile: Earth and Planetary Sci. Letters, v. 1, no. 5, p. 348–350, illus., table, 1966.

Soft scaly coatings of both aragonite and calcite were observed on sand and gravel particles at a depth of 0.6–1 m in a soil profile developed in a temperate climate in southern Ontario, Canada. The presence of the aragonite is believed to be related to warm soil temperatures and an abundance of Mg in the dolostone rich sand and gravel deposit. The presence or absence of aragonite may prove of value in differentiating between warm interglacial and cool interstadial soil profiles.—Authors' abstract

7357 **Quinn, James Harrison.** The Pitkin and superjacent formations in northern Arkansas: Shale Shaker, v. 17, no. 1, p. 2–12, illus., 1966.

Along the northern front of the Boston Mts., from the Oklahoma line to Batesville, a series of Mississippian and Pennsylvanian strata crop out which were deposited in a seaway extending across the southern flank of the Ozark dome. At its northern boundary, the strandline complex is very confusing, but it was conducive to preservation of a rich fossil assemblage. The structural pattern is discussed, and the stratigraphy described, including three measured sections. Goniatites occur in almost all units and can be used to date them. The change in composition of the assemblages from the Mississippian Peyton Creek to Pennsylvanian Hale Formation, is by far the greatest and most complete. The name Cane Hill Formation is rejected in favor of the Imo Formation, which is restricted to include deposits containing *Anthracoceras* and associated goniatites.—E.S.L.

7621 **Quon, Shi Haung.** Geochemistry and paragenesis of carbonatitic calcites and dolomites [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, p. 245B, 1966.

Raabe, R. G. *See* Huff, Lyman C. 7702

7410 **Ramsden, John; Lawton, K. D.; Lovell, Howard.** Otto township (north half), District of Timiskaming: Ontario Dept. Mines Prelim. Geol. Map P.330, scale 1 in. to 1,000 feet, text, 1966.

A syenite stock occupies the entire southern half of the Otto township (north half) map area; the northern half is underlain by tightly folded volcanic rocks ranging from mafic to silicic and including flows, tuffs, agglomerates, and small bands of iron formation. Gold was produced from 1911–1949 on the northwest shore of Otto Lake. In at least three places near the contact of the stock, the syenite contains nepheline. The belt of volcanic rocks occupying most of the northern half of the map area is probably a syncline whose axis is approximately parallel to the boundary of the syenite stock that lies to the south.—M.C.M.

7536 **Rasetti, Franco.** Revision of the North American species of the Cambrian trilobite genus *Pagetia*: Jour. Paleontology, v. 40, no. 3, p. 502–511, illus., 1966.

This study was based on all the material of *Pagetia* from the Middle Cambrian strata of Quebec, British Columbia, and Idaho available in the U.S. National Museum and the writer's collections. Seven previously described species, 3 new ones (*P. quebecensis, P. rugosa, and P. walcotti*), and a new subspecies (*P. billingsi inermis*) are described and figured. A Lower Cambrian form from British Columbia is figured but left unnamed. Only two species from the Lower Cambrian of New York are taken into consideration, since they were adequately described and illustrated.—Author's abstract

Raup, David M. *See* Weber, Jon N. 7292

Raup, David M. *See* Weber, Jon N. 7295

7520 **Raup, David M.** Crystallographic data for echinoid coronal plates: Jour. Paleontology, v. 40, no. 3, p. 555–568, illus., 1966.

Crystal orientation data for ambulacral and interambulacral plates of 135 fossil and Recent species are presented. The new sample is dominated by species that have either perpendicular, tangential, or a combination of perpendicular and tangential *c* axes in the coronal plates. Seventeen species in six families exhibit ontogenetic variation in crystal orientation. Ontogenetic variation in Arbaciidae and Toxopneustidae is distinct from that in Echinometridae, Strongylocentrotidae, Conulidae, and Oligopygidae. The new data support placement of Oligopygidae in order Holectypoida, but raise questions as to oligopygid affinities of genus *Haimea*. Family Arbaciidae is extremely heterogeneous crystallographically; the data suggest it is polyphyletic. Variation in arbaciid crystallography is in good agreement with Mortensen's informal division of the family in five "groups".—*from* Author's abstract

7422 **Ray, Clayton E.** The status of *Bootherium brazosis*: Texas Memorial Mus. Pearce–Sellards Ser., no. 5, 7 p., illus., 1966.

The fossil musk ox *Bootherium brazosis* Hesse 1942 [Pleistocene, Brazos County, Texas] was distinguished as a species largely on the basis of spurious characters founded upon the misorientation of the type specimen. Correct orientation reveals that *B. brazosis* is conspecific with and a junior synonym of *B. sargenti* Gidley 1908.—Author's abstract

7424 **Ray, Clayton E.** The identity of *Bison appalachicolus*: Acad. Nat. Sci. Philadelphia Notulae Naturae, no. 384, 7 p., illus., 1966.

Bootherium appalachicolus (Rhoads), first described as a *Bison* [in 1895, from Pleistocene deposits of Durham Cave, Bucks County, Pa.], but long referred to the living musk ox genus *Ovibos*, is here placed in the extinct musk ox genus, *Bootherium*, and compared especially to *B. sargenti*.—Author's abstract

7511 **Reardon, Richard J.** (editor). Caves of the Sequoia region, California: Natl. Speleol. Soc. Guidebook 7, 37 p., illus., 1966.

The guide to the Sequoia region contains two papers on the geology, which are cited separately, and one on biology. Fifty-five caves are listed and described briefly, and twelve are mapped.—E.S.L.

Renfro, H. B. *See* Oetking, Philip. 7302

7568 **Richard, Kenyon; Courtright, James H.** Structure and mineralization at Silver Bell, Arizona, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 157–163, illus., geol. map, revised 1966; originally published 1954.

Production at the Silver Bell mining district began with opening of Boot mine, later known as Mammoth, in 1865. At present about 18,000 tons of copper is being

produced annually. Copper mineralization occurs along the flank of the Silver Bell Mts. in hydrothermally altered intrusive rocks. The zone of alteration follows an alinement, hidden by the Laramide intrusions, but parallel to two major faults. Several thousand feet each of Paleozoic and Cretaceous rocks are present. Three units of early Tertiary(?) volcanic and sedimentary rocks are recognized. Intrusive activity is described. Structural control of hypogene mineralization, supergene enrichment, and leached outcrops are discussed.—E.S.L.

Richards, J. R. *See* Cooper, J. A. 7579

Richardson, Everett V. *See* Jopling, Alan V. 7676

Richter, W. *See* Eglinton, G. 7457

7474 **Roberts, W. J.** Memorial to Dr. Max Suter (1889–1966): Water Resources Bull., v. 2, no. 2, p. 2, 1966.

7327 **Robie, Richard A.; Bethke, Philip M.; Toulmin, Martha S.; Edwards, Jerry L.** X-ray crystallographic data, densities, and molar volumes of minerals, Sec. 5 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 27–73, tables, 1966.

X-ray crystallographic data provide one of the most accurate methods for phase and/or compositional determination of minerals. Selected data for about 300 minerals, tabulated from recent literature and unpublished sources, are grouped following Dana's System. Included are data for several phases not known as minerals, which form end members of solid solutions and also cell parameters for hypothetical compounds. The material has been expanded since 1962, when the tables were prepared; a revision is available as an open-file U.S. Geological Survey report.—G.D.C.

7342 **Robie, Richard A.** Thermodynamic properties of minerals, Sec. 20 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 437–458, tables, 1966.

Since the publication of the National Bureau of Standards comprehensive tables of thermochemical properties (Rossini and others, 1952), a large body of modern calorimetric and equilibrium data has become available; a complete revision of this reference is needed. The tables given here present critically selected values for the heat and free energy of formation, the logarithm of the equilibrium constant of formation Log K_f, the entropy, and molar volume, at 25.0°C and 1 atmosphere for minerals. Data are given for most oxides so that the conversion to elements as reference states may be carried out for most silicates. The formula weights are based on the International Atomic Weights for 1957.—G.D.C.

7293 **Robinson, Peter.** Fossil Mammalia of the Huerfano formation, Eocene of Colorado: Yale Univ. Peabody Mus. Nat. History Bull. 21, 95 p., illus., tables, 1966.

The Paleocene–Pliocene stratigraphy of the Huerfano basin is discussed, especially the interfingering and terminology of the Eocene Huerfano and Farisita Formations. The structural geology, geomorphology, and geologic history of the area are reviewed. Fossil mammals have been found in 11 major and several minor localities. Two definite faunal levels preserved in the Huerfano and Farisita are the Garcia Canyon and Gardner Butte local faunas. The Gardner Butte, on the basis of its fauna, is proposed as a substage of the Wasatch. Systematic descriptions of the mammals are given and an appendix contains seven measured sections.—E.S.L.

7565 **Robinson, R. F.; Cook, Annan.** The Safford copper deposit, Lone Star mining district, Graham County, Arizona, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 250–266, illus., tables, 1966.

The sequence of rocks exposed in the area is tabulated, described, and shown on sketch maps and diagrams. Aside from quartzite xenoliths, these are the San Juan

stock and other intrusive rocks, and three volcanic series. The older volcanic series (Cretaceous?) contains the orebody, localized by shear zones, where many small dikes intruded. After mineralization, the orebody was exposed to oxidation and enrichment, and covered by later Tertiary volcanic rocks. It outcrops only in a small window. Mineralization and alteration are discussed in detail, and some of the exploration methods are described. This is the only North American porphyry-type copper deposit occurring entirely in volcanic rock.—E.S.L.

7442 **Robinson, S. C.** (compiler). Storage and retrieval of geological data in Canada—Interim report by the *ad hoc* Committee of the Natl. Advisory Comm. on Research in the Geol. Sci.: Canada Geol. Survey Paper 66-43, 98 p., illus., tables, 1966.

The committee reviewed the advantages and problems involved in developing a single system for storage of data of various disciplines, and concluded that because data are so complex and diverse, a single system would be too ponderous. Instead, it is recommended that systems be developed for each of the main files needed, and that these be linked by standardization of factors common to all. These factors are: geographic location, reference numbers, method for recording descriptive data, coding of standard names and terms. A chapter is devoted to each of these, and additional chapters cover the national index, and data on mineral deposits and fossil fuels. Appendixes and tables give supplementary information.—E.S.L.

Ronca, L. B. *See* Salisbury, J. W. 7711

7541 **Rose, Arthur W.; Baltosser, Will W.** The porphyry copper deposit at Santa Rita, New Mexico, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 205-220, illus., tables, 1966.

The Santa Rita deposit is in a large mining district, characterized by abundant faulting and a complex sequence of hypabyssal igneous rocks. It is localized in and around a granodiorite porphyry stock. Close control of the district, the stock, and orebodies, by structural features is shown. Paleozoic to Tertiary formations and intrusive rocks are tabulated. Santa Rita is probably one of the better examples of supergene enrichment, which was controlled by the contact zone of the stock, as were the hypogene mineralization and alteration. Lead and zinc deposits are zonally related to the copper. Important amounts of limestone replacement copper ores are closely associated with the disseminated mineralization. Magnetite is the most abundant mineral in these copper-bearing tactites, so Santa Rita forms a link between typical porphyry copper deposits and pyrometasomatic copper deposits.—E.S.L.

Rose, Arthur W. *See* Metz, Robert A. 7569

Roth, Barry. *See* Coan, Eugene. 7628

Roth, R. I. *See* Kauffman, A. E. 7289

7434 **Rouxhet, P. G.; Brindley, G. W.** Experimental studies of fine-grained micas—[Pt.] 2, The water content of wet-ground micas: Clay Minerals, v. 6, no. 3, p. 219-228, illus., tables, 1966.

The water gained by two micas during a wet-grinding process (extra-water) has been evaluated. It was found to be proportional to the surface area and the amount was about 29 μmoles/m^2 for a fluorphlogopite and about 16 μmoles/m^2 for a muscovite. This estimation was made possible by eliminating the physically adsorbed water. The material contaminating the surfaces and the constitution water of muscovite were taken into account by the comparison of the two minerals and by the use of infrared spectroscopy in addition to thermovolumetric data. It is thought that the extra-water is related to a disordered and chemically modified surface layer of the particles. The bearing of these results on the nature of illite is indicated.—Authors' abstract

7431 **Rowell, A. J.** Revision of some Cambrian and Ordovician inarticulate brachiopods: Kansas Univ. Paleont. Contr.—Paper 7, 36 p., illus., tables, 1966.

Well-preserved specimens freed from matrix by formic acid permit study of internal morpholgical features, as well as exteriors of shells. Based on such material, ten species of inarticulate brachiopods (all previously described by Walcott [from western interior U.S.]) are redescribed in detail for the purpose of reporting variation in many characters. The species are distributed among nine genera (five new) classed in the families Acrotretidae, Siphonotretidae, and Obolidae. Biometric data are recorded both numerically and graphically, thus adding precision to descriptive differentiation.—Author's abstract

7287 **Rowett, Charles L.** Studies of Pennsylvanian corals in Oklahoma—Pt. 1, Tabulate corals of the Wapanucka Formation: Oklahoma Geol. Survey Circ. 72, p. 5–33, 54–58, illus., table, 1966.

Tabulate corals from the Lower Pennsylvanian (Morrow Series) Wapanucka Formation of southern Oklahoma include four genera and ten species: *Striatopora cf. S. religiosa, Acaciapora subcylindrica, Michelinia referta, M. scopulosa, M. spissata, M. tenuicula, M. latebrosa, M. cf. M. meekana, Cladochonus fragilis, and C. texasensis.* The distribution of these fossils in the Wapanucka Formation appears to have been independent of marked environmental or stratigraphic control.—Author's abstract

Rubin, Meyer. *See* Woodcock, Alfred H. 7439

7679 **Runcorn, S. K.** Corals as paleontological clocks: Sci. American, v. 215, no. 4, p. 26–33, illus., 1966.

This semi-popular article summarizes the observations that certain corals, both fossil and modern, possess banding that is thought to represent annual, monthly, and daily growth. As determined from these growth rings, the length of years, months, and days in the geologic past may offer clues to the history of the Earth and Moon. The length of ancient days should help determine whether the Earth is expanding or contracting. Slichter's calculation, based upon modern values of tidal friction, that the Earth and Moon were close to each other two billion years ago must be reckoned with in any theory of origin of the Moon.—D.W.R.

7615 **Runge, Erwin John, Jr.** Continental shelf sediments, Columbia River to Cape Blanco, Oregon [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, p. 212B–213B, 1966.

Rust, B. R. *See* Tuke, M. F. 7592

7604 **Sachdev, Sham Lal.** New methods for the determination of trace quantities of vanadium [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, p. 69B, 1966.

7444 **Sackett, William M.** Manganese nodules—Thorium-230/protactinium-231 ratios: Science, v. 154, no. 3749, p. 646–647, table, 1966.

The Th-230:Pa-231 activity ratio in 7 of 11 manganese nodules is less than 10.8, the theoretical production ratio of activities in the ocean. This finding indicates differential accumulation of these nuclides in authigenic deposits of manganese-iron oxide.—Author's abstract

Sainsbury, C. L. *See* Scholl, David W. 7407

7616 **Saint John, Billy Eugene.** Structural geology of Black Gap area, Brewster County, Texas [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, p. 213B, 1966.

7711 **Salisbury, J. W.; Ronca, L. B.** The origin of continents: Nature, v. 210, no. 5037, p. 669–670, illus., 1966.

The possible role of the impact of large meteorites or asteroids in the formation of continental nuclei is examined. It is proposed that after such impact a new M-discontinuity may be formed, deeper than before; heat released at the surface causes cooling and downflow in the mantle, with attendant sinking and compression. When heat loss is terminated, downflow stops and the continental nucleus rises. Downflow

may restart at the borders, resulting in geosyncline formation and continental growth.—D.B.V.

7301 **Salsman, G. G.; Tolbert, W. H.; Villars, R. G.** Sand-ridge migration in St. Andrew Bay, Florida: Marine Geology, v. 4, no. 1, p. 11–19, illus., table, 1966.

A series of remarkably uniform sediment ridges found on the bottom of this bay were measured, bottom samples obtained, and sediment movement monitored over a period of two years, recording the current flow. Ridges were oriented normal to the current flow and were composed of a fine-grained quartz sand, with heights of 30–60 cm and wavelengths of 13–20 m; they were migrating into an area previously characterized as mud. During the 849-day investigation one ridge advanced a total of 11.44 m. The migration rate varied periodically in response to tides, being greater when the Sun and Moon were near maximum declination, and smaller when they were near the celestial equator. Also detected was a gradual increase in ridge-migration speed apparently related to a decrease in ridge height and a long-term increase in current speed.—G.D.C.

7234 **Santoro, A.; Zocchi, M.** Multiple diffraction in the Weissenberg methods: Acta Cryst., v. 21, pt. 3, p. 293–297, illus., 1966.

The conditions for multiple diffraction due to symmetry have been derived for the Weissenberg geometry, for the various crystal systems and for the most commonly used rotation axes. The orientation of the crystal with respect to the direction of the incident beam and the nature of the rotation axis are the factors responsible for the simultaneous diffraction by symmetry. The values of μ used in the normal-beam, equi-inclination and flat-cone methods determine a symmetrical relation between the reciprocal levels and the reflection sphere. Since in the equal-cone method this symmetrical relation can be avoided by using a proper value of μ, a conclusion of this paper is that the equal-cone method is the most appropriate in intensity measurements.—Authors' abstract

Santos, Elmer. *See* Huff, Lyman C. 7702

Saraf, D. N. *See* Witherspoon, P. A. 7460

7265 **Satterfield, Ira R.** Petrographic and modal analysis of the andesite of Marble Creek, southeastern Missouri: Illinois Acad. Sci. Trans., v. 59, no. 3, p. 207–211, illus., table, 1966.

A detailed field and petrographic investigation was made of the andesite of Marble Creek in the St. Francois Mountains of southeastern Missouri. The area is characterized by hills of Precambrian granitic and felsitic rocks which rise topographically above unconformably overlying Cambrian strata. The andesite has a porphyritic texture, contains an abnormally high percentage of plagioclase, quartz, and only minor amounts of biotite, hornblende, and augite. Petrographic and field studies lead the author to believe that the andesite was a flow.—Author's abstract

Saull, V. A. *See* Kumarapeli, P. S. 7691

7242 **Schaeffer, O. A.** Tektites, *in* Potassium argon dating: New York, Springer Verlag, p. 162–173, tables, 1966.

One of the main features of tektites is that they occur in rather extensive strewn fields, which indicate that they may be the only clues to some past cataclysmic events. The experimental technique for K–Ar dating of tektites is reviewed, and dates of strewn fields are tabulated and discussed. In the australites there is a discrepancy between K–Ar age and geologic age. The ages indicate that each strewn field is a discrete individual event. K–Ar dating of glass from large meteorite craters near two of the strewn fields agrees with the tektite ages.—E.S.L.

7243 **Schaeffer, O. A.; Zähringer, J.** (compilers). Potassium argon dating: New York, Springer-Verlag, 234 p., illus., tables, 1966.

This book, dedicated to Wolfgang Gentner on his 60th birthday, is the first work to summarize the K–Ar experimental techniques and the results available, though this method has been in use for 15 years. It contains nine papers which are cited separately.—E.S.L.

7392 **Schairer, J. F.** Memorial to George Washington Morey (1888–1965): Geol. Soc. America Bull., v. 77, no. 8, p. P161–P163, portrait, 1966.

7671 **Schermerhorn, L. J. G.** Terminology of mixed coarse–fine sediments: Jour. Sed. Petrology, v. 36, no. 3, p. 831–835, 1966.

No adequate terms exist which describe the class of ill-sorted, megaclastic sediments of doubtful origin resembling glacial till. The nongenetic term mixtite is proposed for all such rocks including known tills and tillite. The term aquatillite is proposed as the genetic term for glaciomarine and glaciolacustrine sediment which falls within this general class.—R.A.C.

7685 **Schilder, Franz Alfred.** Personal views on taxonomy: Veliger, v. 8, no. 3, p. 181–189, illus., 1966.

The author discusses principles of his system of intraspecific taxonomy for fossil and Recent (Cenozoic) cowries (Gastropoda, Cypraeidae), based on evolutionary stages. Intraspecific taxa are discussed under groupings of those taxa which must be named, those which can be named, and those which must not be named; a diagram shows relations between the different levels.—V.M.J.

7680 **Schilling, Jean-Guy; Winchester, John W.** Rare earths in Hawaiian basalts: Science, v. 153, no. 3738, p. 867–869, illus., tables, 1966.

Rare-earth elements have been determined by neutron activation analysis in 20 basalts from the Hawaiian Islands. The abundance patterns of these elements form groups coinciding closely with groupings based on other evidence, and a fractional crystallization mechanism for change in rare earth abundance is implied.—Authors' abstract

Schmidt, Victor A. *See* White, William B. 7497

7546 **Schmitt, Harrison A.** The porphyry copper deposits in their regional setting, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 17–33, illus., 1966.

The principal structural elements of the Southwest are described in detail, and their relation to the sedimentation, erosional history, and igneous activity, are discussed. The principal systems of deformation are: the older Precambrian northeast system, the meridional system, and the west to west-northwest transverse system. Continental and intercontinental considerations of such structures as the Texas zone and Menard's East Pacific Rise, are given. Ore deposits are associated with major fault zones, orogens, tectogenes, and especially their intersections. Most of the great copper deposits occur along the Wasatch-Jerome orogen, particularly at its intersection with the Texas zone. Discussion by H. W. Menard and H. H. Schmitt, with the author's replies, is included.—E.S.L.

7407 **Scholl, David W.; Sainsbury, C. L.** Marine geology of the Ogotoruk Creek area, Chap. 27 *in* Environment of the Cape Thompson region, Alaska: U.S. Atomic Energy Comm. Rept. PNE-481, p. 787–806, illus., tables, 1966.

The nearshore shelf of the Chukchi Sea was investigated, and four topographic units are described. Outcrops of Paleozoic and Mesozoic formations on the shelf indicate that it is a wave-planed platform, planation probably occurring in Sangamon and pre-Sangamon time. It is suggested that Ogotoruk Sea valley is the drowned subaerial valley of Ogotoruk Creek excavated during periods of glacially depressed sea level. Unconsolidated sediment overlying the nearshore shelf is mostly slightly rounded residual gravel derived from submerged outcrops. Lesser amounts of sand and silt deposited in Recent time overlie the shelf along most of the coast. Owing to swift currents and the small volume of detrital clasts from the coastal area, detrital

sediment does not accumulate rapidly on the nearshore shelf.—*from* Authors' abstract

7667 **Schreyer, W.; Chinner, G. A.** Staurolite–quartzite bands on kyanite quartzite at Big Rock, Rio Arriba County, New Mexico [with German abs.]: Contr. Mineralogy and Petrology, v. 12, no. 3, p. 223–244, illus., tables, 1966.

Concordant "igneous-looking" bands of ferruginous bulk composition in a Precambrian metasedimentary predominantly kyanite quartzite series, contain quartz in three types differing in appearance as well as origin, staurolite showing radial sieve textures caused by mimetic crystallization after preexisting chloritoid rosettes, and chloritoid largely consumed, but the remainder in stable equilibrium with other minerals. The staurolite quartzites represent original sedimentary bands which have undergone several stages of recrystallization and possibly metasomatism; their "igneous aspect" is due to annealing crystallization during a postdeformational, thermal event of regional metamorphism. Chemical analysis of the staurolite shows no unusual features. The assemblage chloritoid–staurolite may be stable in regional metamorphism over a limited pressure–temperature range.—G.D.C.

7463 **Schulte, Frank J.** The Edinburg moraine of northeastern North Dakota: North Dakota Acad. Sci. Proc. 1965, v. 19, p. 45–53, illus., table, 1966.

Determination of the age of the Edinburg moraine is very important in interpreting late Pleistocene history. Its physical characteristics were examined by mapping, till-fabric analyses, pebble and boulder composition, and sediment-size analyses. The moraine is separated by a paleosol from the Pisek till ridge formerly included in it, so is less extensive than previously mapped; it is crossed by two strand lines of Lake Agassiz I, so was probably formed during Mankato time, not Valders. It is concluded that the Valders ice never advanced into North Dakota.—E.S.L.

7548 **Schwartz, George M.** The nature of primary and secondary mineralization in porphyry copper deposits, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 41–50, illus., 1966.

Because of the broad usage of the term porphyry copper, this discussion is centered on the host rocks of igneous origin. Geologic relations and controlling structure are described. A general statement on hydrothermal alteration is presented, and the mineral and chemical changes involved are discussed in detail. The metallic minerals form a relatively simple assemblage. Primary and supergene sulfides, as well as oxidized zone minerals, are described. A section on supergene enrichment concludes the paper.—E.S.L.

Schweiger, F. *See* Godfrey, L. M., Jr. 7247

Scott, P. M. *See* Eglinton, G. 7457

Scott, Verne H. *See* Kriz, George J. 7553

Scott, Verne H. *See* Kriz, George J. 7554

Seed, H. Bolton. *See* Duncan, James M. 7552

7427 **Segal, Ronald H.** *Biorbia* (Boraginaceae) in the central U.S. Pliocene: Kansas Univ. Sci. Bull., v. 46, no. 15, p. 495–508, illus., 1966.

This paper presents a taxonomic revision of the genus *Biorbia*, which is the most abundant fossil found in the Ogallala Formation of the Great Plains region. A map gives the distribution, and graphs show relative size. Drawings and photographs illustrate the nutlets. Plant fruits found in the Ogallala are listed.—E.S.L.

7251 **Shacklette, Hansford T.** Phytoecology of a greenstone habitat at Eagle, Alaska: U.S. Geol. Survey Bull. 1198-F, p. F1–F36, illus., tables, 1966.

A plant community is described that owes its existence at this site to both the chemical nature of the substrate and the absence of glaciation. A study of the geochemical cycle here enables an evaluation of the amounts and movements of the chemical elements, and an examination of the floristic composition and phytosociology of the plant community confirms the glacial history of the region that has been deduced from geologic evidence. The distinctive species have survived at this site because of freedom from glaciation and because the chemical and physical nature of the soil has prevented or reduced competition with species that are more "aggressive" but less tolerant of toxic elements.—*from* Author's abstract

Shaffer, M. E. *See* Vanderford, H. B. 7270

Shafiqullah, M. *See* Boyle, R. W. 7589

7696 **Shaw, Alan B.** Paleontology of northwestern Vermont—[Pt.] II, Fossils from the Middle Cambrian St. Albans Shale: Jour. Paleontology, v. 40, no. 4, p. 843–858, illus., 1966.

Several collections of fossils containing 17 named and 4 unnamed species form the basis for reviewing fauna of the St. Albans Shale. These appear to warrant recognition of the *Paradoxides forchammeri* Zone in the upper part; strata in the lower 30 feet are of pre-*forchammeri* age and probably belong to the upper *Paradoxides davidis* Zone, not hitherto recognized in Vermont. Discovery of widespread Atlantic Province species *Meneviella venulosa* (Salter), 1865, assists in this assignment. One new family, Onchonotopsididae, is proposed to receive *Onchonotopsis and Matania*, genera erected by Rasetti in 1946. *"Alokistocarella" albansana* is the only new species named. More complete descriptions are presented for *Centropleura vermontensis* Howell, 1932, and *Onchonotopsis pergibba* Rasetti, 1946.—*from* Author's abstract

7470 **Shelton, John S.** Geology illustrated: San Francisco, Calif., W. H. Freeman and Co., 434 p., illus., 1966.

The photographs and drawings are arranged in sequences that develop some of the main principles of geology; the majority are from western and southwestern United States. The text serves as an expanded legend for the pictures, supplying the interpretation. Part 1, on materials, covers the origin of the three main classes of rocks. Structure is covered in Part 2, with five chapters on original structure, deformation, and unconformities. Part 3 is devoted to surface sculpture, with chapters on eight processes. Geologic time, and events in the vicinity of Grand Canyon, comprise Part 4. Part 5 is case histories in 11 different processes. The 6th, and concluding part, is called implications, and deals with crustal movement. An index of features and processes lists all figures in which they may be recognized.—E.S.L.

7394 **Shepard, Francis P.; Dill, Robert F.** Submarine canyons and other sea valleys: Chicago, Ill., Rand McNally and Co., 381 p., illus., tables, 1966.

Published and unpublished results of the authors' extensive exploration of sea-floor valleys in many parts of the world from surface ships and from diving operations are summarized. Besides the common dendritic rock-wall canyons, there are straight troughs in sediments off large deltas, winding distributary valleys with natural levees, on fans at the base of continental slopes, discontinuous slope valleys on delta fronts and fault scarps, valleys parallel to tectonically active land structures, and various valleys limited to the continental shelf. Some are explained by faulting, some by slumping, creep, drowning, and glacial ice. Turbidity currents are still a mystery; effects of other types of currents have yet to be evaluated accurately.—G.D.C.

7703 **Shepard, Francis P.** Meander in valley crossing a deep-ocean fan: Science, v. 154, no. 3747, p. 385–386, illus., 1966.

Seaward of most submarine canyons there are large sediment fans comparable to the fans at the base of mountain ranges. Many of the submarine fans are cut by valleys called fan-valleys which usually connect with the mouths of rivers in their lower flood plains, but have never been found in the shallow channels that cross

the alluvial fans at the base of mountain canyons. Therefore, it was surprising to find that the channel in a very deep submarine fan-valley off Monterey Bay, California, has a tight meander.—Author's abstract

7718 **Shepard, William M.** Geochemical studies in the Tintic mining district: Mining Eng., v. 18, no. 4, p. 68–72, illus., 1966.

The classic studies in the Tintic district by the U.S. Geological Survey on hydrothermal alteration and geochemical prospecting are reviewed. Recently mining companies in the area have done more detailed mineralogical work on the alteration stages most closely related to ore. Five alteration zones (equivalent to T. S. Lovering's late barren and early productive stages), concentrically arranged around the up-dip projection of a mineralized structure are recognized and described: strong sericite-pyrite zone; kaolinite-sericite-moderate pyrite (transitional) zone; kaolinite-weak pyrite zone; weak pyrite (outer) zone; and supergene alteration zone.—C.B.D.

7694 **Sheridan, R. E.; Drake, C. L.; Nafe, J. E.; Hennion, J.** Seismic refraction study of continental margin east of Florida: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 9, p. 1972–1991, illus., table, 1966.

Data from 31 seismic refraction profiles indicate that the basement plunges seaward from Florida into a deep sedimentary trough under the Blake Plateau. The marked relief of the Florida shelf, the Florida Straits, and the Blake Plateau is evident only in the sedimentary layers. The top of the Paleocene extends beneath the present physiographic irregularities with slight relief, whereas the Eocene thickness ranges from about 500 m on Florida to about 70 m in the Blake Plateau. Strong currents sweeping the Florida Straits and the Blake Plateau probably are responsible for the absence of a thick post-Paleocene section. Within the sedimentary section are lateral facies changes, and velocity variations that are primarily dependent on the depth of burial.—W.C.C.

Shimizu, Hiromu. *See* Hashimoto, Seiji, 7437

7411 **Shklanka, R.** Steeprock Lake Iron area, District of Rainy River: Ontario Dept. Mines Prelim. Geol. Map P.348, scale 1 in. to 1,000 feet, text, 1966.

The geology of the Steeprock Lake Iron area is complicated through repeated folding and faulting and its solution is hampered by extensive shearing and carbonatization, poor rock exposure, and a difficult terrain. The major structural break is the Quetico fault system in the southern part. Iron is of major importance and total production to the end of 1965 amounted to 45,103,251 tons valued at 381,477,031 dollars. Iron occurs as concordant deposits of goethite-hematite, waterlain glacial gravels, and replacement magnetite-pyrite occurrences.—M.C.M.

7368 **Shotts, Reynold Q.** Pea Ridge—Does it preserve "fossil" stratigraphy?: Alabama Acad. Sci. Jour., v. 37, no. 2, p. 163–167, illus., 1966.

Pea Ridge is located on Sand Mtn., near Stevenson, Ala. It runs at right angles to the trend of the mountain and to the strike of the beds, and seems to be an erosion remnant preserving much younger strata than are found anywhere else in the area, but there are some signs of structural disturbance also. The thick sandstone outcropping at around 1,630 feet is higher than the Upper Conglomerate and appears to be in the Walden Formation, but might correlate with the Newton or Sewanee Sandstones, also of Lower Pennsylvanian age.—E.S.L.

7274 **Shrum, John W.** Recommendations for a basic academic preparation for earth science teachers: Jour. Geol. Education, v. 14, no. 1, p. 26–27, 1966.

This is a report of conferences and discussions on teacher preparation held by the Earth Science Curriculum Project, a course content improvement program in earth science supported by the National Science Foundation. Defined as the interdisciplinary study of materials, energy, and processes in solid earth and its interior, atmosphere, hydrosphere, and its environment in space, the program of study should include investigative laboratory work concerned with the Earth and

in at least two of the other three areas. At least one-half of the study should be at junior-senior high level in one of these areas, or in an integrated program combining two or more of them, with at least four weeks of full-time practical field experience in one area. Related sciences needed in support should include one year each college-level biology, chemistry, mathematics, and physics.—G.D.C.

7462 **Sigsby, R. J.** The present general lack of "scoria" in two burning lignite areas in North Dakota: North Dakota Acad. Sci. Proc. 1965, v. 19, p. 7–14, illus., 1966.

Of two large burning lignite beds investigated, the bed at Buck Hill in the Medora area, was discovered to be burning in 1951, while the bed near Amidon has been burning for more than 60 years; very little "scoria" has formed on either. Temperature range in the hottest zones is below that needed for fusion of overburden. An environment in which the lignite undergoes partial distillation seems to be necessary for "scoria" to form, as evidenced by the coke-like layers usually underlying it. The process is described and the lack of "scoria" in these two areas attributed to an insufficient thickness or competence of overburden.—E.S.L.

7567 **Simmons, W. W.; Fowells, J. E.** Geology of the Copper Cities mine, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 151–156, 1966.

The Copper Cities mine, Miami district, Gila County, Ariz., is a comparatively small low-grade deposit. The orebody is entirely in intrusive igneous rocks of Laramide age, the principal being Lost Gulch Quartz Monzonite, the two textural varieties of which are described. The monzonite is intruded along a northeastward zone, perhaps representing a long existing structural trend; the orebody is bounded by faults. Mineralization, alteration, ore controls, and supergene enrichment are discussed. The lack of mineralization and hydrothermal alteration in the nearby pre-mineral sedimentary rocks is noted.—E.S.L.

7361 **Simon, Jack A.** Shipping coal mines in Illinois: Urbana, Ill., Illinois State Geol. Survey, scale 1:500,000, 1966.

7328 **Skinner, Brian J.** Thermal expansion, Sec. 6 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 75–96, tables, 1966.

Tables given here contain the expansions of selected substances, many artificial and of more physical or ceramic interest than geologic, but including elements and mineral groups as well as minerals and rocks. Thermal expansion of rocks are given only to 100°C, since the effects of high temperature and one atmosphere pressure on aggregates of many different crystals have little relation to the expansion of rocks buried even to moderate depths. What is actually measured in laboratory expansions of rock specimens is the increase in porosity rather than true thermal expansion. Averaging the weighted volumetric expansions of the constituent minerals may give a better figure for the rock at depth.—G.D.C.

7532 **Sloane, Howard N.; Gurnee, Russell H.** Visiting American caves: New York, Crown Publishers, 246 p., illus., 1966.

This tourist guide includes all caves open to the public. Introductory sections give descriptions of types of caves, speleothems, fossils, and fill. For the guide itself, the United States has been divided into nine regions, and the caves are described under these by states.—E.S.L.

7603 **Slowey, James Frank, Jr.** Studies on the distribution of copper, manganese and zinc in the ocean using neutron activation analysis [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, p. 69B, 1966.

7669 **Smalley, I. J.** The properties of glacial loess and the formation of loess deposits: Jour. Sed. Petrology, v. 36, no. 3, p. 669–676, illus., 1966.

Detrital quartz produced by glacial erosion of granitic rocks consists of mixed but discrete sand-sized and fine silt-sized populations. Eolian erosion, transportation, and deposition of the detrital quartz differentiates the two particle-size populations

into dune and loess deposits respectively. Formation of the two kinds of deposits is a function of the properties of eolian transport and the relation of particle size to critical wind velocity. Loess deposits, subject to little reworking are rapidly formed and stabilized. Sand dunes on the other hand are formed slowly and may not be stabilized. Present evidence points to glaciation as the source of loess.—R.A.C.

7418 **Smith, Ida.** Arizona's underground wonderland: Arizona Highways, v. 42, no. 9, p. 28–39, illus., 1966.

Caves of Arizona and their speleothems are described and illustrated with both color and black and white photographs. Exploration of earth cracks is included.—E.S.L.

Smith, J. T. *See* Kunze, H. L. 7655

Smith, J. V. *See* Howie, R. A. 7659

7665 **Smith, J. V.** X ray emission microanalysis of rock forming minerals—[Pt.] 6, Clinopyroxenes near the diopside hedenbergite join: Jour. Geology, v. 74, no. 4, p. 463–477, illus., tables, 1966.

Twenty two chemically analyzed clinopyroxenes were analyzed by electron microprobe for Si, Al, Fe, Mn, Mg, Ca, Na, K, Ti, Cr, Ni, and V. Intergrown phases, sparse and deliberately avoided in probe analysis, systematically bias a bulk chemical analysis, especially toward low Ca and high Mg and Ti. Seventeen analyses give oxides totaling 99–101 percent when Fe'' and Fe''' are distributed according to original chemical analyses; the range for all samples is 97.7–101.0 percent. Microprobe values for Si are generally higher than chemically determined values, those for Al lower, and those for Na and Mn virtually the same, although the correction factor for Na is uncertain. Some generation factors and adjusted count rates reported in Part I are revised. For microprobe data on orthopyroxenes, see Howie and Smith, ibid., p. 443.—B.F.L.

7657 **Smith, John Ward; Milton, Charles.** Dawsonite in the Green River Formation of Colorado: Econ. Geology, v. 61, no. 6, p. 1029–1042, illus., tables, 1966.

Dawsonite ($NaAl(OH)_2CO_3$) is relatively abundant (up to 25 percent) as a rock-forming constituent of a zone within the Green River oil shales in the Piceance Creek Basin, Colorado, and also occurs in Pleistocene ash beds, Olduvai Gorge, Tanzania. The mineral is most readily distinguished from other carbonates of the Green River Formation by optical properties and X-ray diffraction. "In five of the seven known occurrences, the formation of dawsonite has been related to hydrothermal activity connected with volcanic episodes, with varying ore mineralization." The Green River and Olduvai Gorge occurrences, however, are ascribed to reaction of carbonate solutions with nepheline of the original sediments.—W.S.W.

Smith, Norman O. *See* O'Sullivan, Thomas D. 7712

7673 **Smith, Richard E.** Grain size measurement in thin section and in grain mount: Jour. Sed. Petrology, v. 36, no. 3, p. 841–843, illus., 1966.

For the same sandstone samples, grain size determined by microscopic measurement of the long axes of quartz grains in a grain mount is significantly coarser by a constant than grain size determined by measurement of the long axes of grain sections in a rock thin section. The lengths of long and short axes of the same grains or of the same grain sections have a very high degree of correlation.—R.A.C.

Smith, T. K. *See* Lange, G. R. 7226

Smithson, Scott B. *See* Ebens, Richard J. 7515

7620 **Snetsinger, Kenneth George.** Petrology and mineralogy of metamorphic and intrusive rocks, northwest part of the Bass Lake 15′ quadrangle, Madera and

Mariposa Counties, California [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, p. 245B–246B, table, 1966.

7617 **Snipes, David Strange.** Stratigraphy and sedimentation of the Middendorf Formation between the Lynches River, South Carolina, and the Ocmulgee River, Georgia [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, p. 213B–214B, 1966.

7551 **Sørensen, Emil.** På spor af sjaeldne metaller i Sydgrønland—[Pt.] 5, Uran og thorium—Forekomst og undvinding: Grønland 1966, no. 8, p. 275–286, illus., table, 1966.

Radioactive minerals in Greenland occur mainly in the rock, lujavrite; radioactive grains are not evenly distributed and the composition of the rock varies. Borings on Kvanefjeld Plateau yielded 450 g uranium and 1,000 g thorium per ton, but it is possible that four to five times as much could be found in some samples. It is estimated that about 10 million tons of lujavrite are available to yield about 8,000 tons of uranium. Extraction of radioactive minerals in Greenland requires ample supplies of water, and to that end a hydrologic survey of the Narssaq area was begun in 1965. The occurrence of uranium and thorium constitutes an energy reserve that will require geological and mining surveys in addition to laboratory work to provide higher yields of ore at lower costs.—M.C.M.

7618 **Sparling, Dale Richard.** Geology of Ottawa County, Ohio [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, p. 214B, 1966.

7390 **Stanley, D. J.; Krinitzsky, E. L.; Compton, J. R.** Mississippi River bank failure, Fort Jackson, Louisiana: Geol. Soc. America Bull., v. 77, no. 8, p. 859–866, illus., tables, 1966.

A slowly growing bendway of the Mississippi River near Fort Jackson, La., is attributed to failures in deltaic plain sediments which resulted in bank recession. Known failures occurred about 1934, in 1947, and between 1958 and 1962. Each failure destroyed an area about 1,000 feet long and 150–200 feet wide. Comparison of borings made in failed and unfailed parts of the riverbank indicates that deep-seated shear failure takes place, resulting in lateral wedge-type failures initiated by progressive oversteepening of the bank slope by river erosion.

7701 **Stanley, Steven M.** Paleoecology and diagenesis of Key Largo Limestone, Florida: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 9, p. 1927–1947, illus., table, 1966.

Exposed, Pleistocene age Key Largo Limestone forms the upper Florida Keys. About 30 percent is organic framework of coral colonies (*Montastrea annularis* predominates), and 70 percent is a two facies, interstitial calcarenite. The predominant facies has high calcilutite content, is poorly sorted, and surrounds coral heads; the well sorted facies forms channel deposits between coral buildups. Original aragonite and high-magnesium calcite are currently being dissolved, and magnesium removed by leaching, in the meteoric zone. $CaCO_3$ is redeposited as a lithifying, sparry cement and aragonite fossils are now molds of sparry calcite. Exposure accelerates these processes. Similar diagenetic fabrics may characterize ancient limestone units that were subjected to subaerial exposure after deposition.—B.H.K.

7388 **Stanton, Robert J., Jr.** The solution brecciation process: Geol. Soc. America Bull., v. 77, no. 8, p. 843–847, illus., 1966.

A process of developing a breccia from evaporite rocks by simultaneous solution, subsidence, and evaporite flowage is described. The breccias studied come from cores from the Upper Devonian Leduc Formation, Alberta, Canada, and are dolomite clasts in a matrix of dolomite or anhydrite.—R.G.Y.

7451 **Stauffer, Mel R.** An empirical-statistical study of three-dimensional fabric diagrams as used in structural analysis: Canadian Jour. Earth Sci., v. 3, no. 4, p. 473–498, illus., 1966.

A random arrangement of points on a sphere does not result in an isotropic distribution (unless a very large number of points is present), and different samples taken from an infinite number of points arranged into point maximum or great circle girdle patterns vary considerably, depending on the concentration strength and the number of points in the sample. Existing statistical tests are of limited use only, and visual determinations of symmetry and cell grouping are presently the best way to determine the nature of 'preferred orientations', provided that the effects of sample size are given full consideration. It is unwise to consider as significant any feature of a natural fabric that could reasonably have occurred as a natural sampling variation.—Author's abstract

Stewart, D. *See* Godfrey, L. M., Jr. 7247

7523 **Stinchcomb, Bruce L.; Echols, Dorothy Jung.** Missouri Upper Cambrian Monoplacophora previously considered cephalopods: Jour. Paleontology, v. 40, no. 3, p. 647–650, illus.; 1966.

A zone containing fairly abundant specimens of *Hypseloconus* (Monoplacophora) is recorded from the Potosi Formation of Missouri. Potosi specimens of *Hypseloconus* are identical to the problematical form *Shelbyoceras bessemerense* Ulrich, Foerste and Miller, 1943, from the Copper Ridge Dolomite of Alabama, and *S. cf. S. bessemerense* from the Potosi Formation of Missouri. These forms are here referred to the Monoplacophora as *Hypseloconus bessemerense*. Another species of *Shelbyoceras, S. buttsi* Ulrich, Foerste and Miller, 1943, is considered a synonym of *Hypseloconus bessemerense*. These forms originally described as *Shelbyoceras* lack characteristics of cephalopods.—Authors' abstract

7378 **Stockwell, C. H.; Tupper, W. M.** Geology of the Brunswick No. 6 and No. 12 mining area, Gloucester county, New Brunswick: Canada Geol. Survey Paper 65–13, 8 p., geol. map, 1966.

The map area is underlain mainly by the Middle Ordovician Tetagouche Group, the petrology of which is given. These rocks were intruded by a Devonian granodiorite stock and smaller bodies. The dominant structure is a broad north–trending S–shaped flexure. Two large banded zinc–lead–silver–copper sulfide deposits occur in the map–area, both lying in south–plunging folds.—E.S.L.

7666 **Story, James A.; Wessels, Vincent E.; Wolfe, John A.** Radiocarbon dating of Recent sediments in San Francisco Bay: California Div. Mines and Geology Mineral Inf. Service, v. 19, no. 3, p. 47–50, illus., table, 1966.

In 1962, 107 test holes were drilled through the San Francisco Bay mud, and carbon–14 dates were determined on oyster shells and peat from five representative holes. Ages range from 2,300 to 7,360 years according to depth; the shell is found above 32 feet, but peat extends down to 50 feet. An idealized cross section shows the inferred relations. It is concluded that the bay mud formed during and after melting of the Wisconsin glaciers, sea level rose slowly from 6,150 to 4,685 years ago, and the main biostrome formed 2,500 to 2,300 years ago.—E.S.L.

7547 **Stringham, Bronson.** Igneous rock types and host rocks associated with porphyry copper deposits, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 35–40, tables, 1966.

The compositions, textures, structural classification, and sequence of development of the intrusive rocks in 24 copper districts of the southwestern United States are described and summarized in a table. Another table covers the intruded and mineralized rocks. In half the districts the orebodies occur almost exclusively in the intrusive rocks. In summary, several consistent geologic and mineralogic conditions brought to light by statistical evaluation of these facts, are presented to aid in exploration.—E.S.L.

Stromquist, Arvid A. *See* Henderson, John R., Jr. 7632

Stroud, Lowell. *See* Emerson, David E. 7482

7235 **Swallow, A. G.; Ahmed, F. R.; Barnes, W. H.** The crystal structure of pascoite, $Ca_3V_{10}O_{28}\cdot 17H_2O$: Acta Cryst., v. 21, pt. 3, p. 397–405, illus., tables, 1966.

The crystal structure of pascoite has been determined from Patterson and Fourier syntheses with the use of 3-dimensional counter data for 1,984 observed reflections. Refinement has been carried out by differential and least-squares methods; data are tabulated and illustrated by projection diagrams. An ordered structure is favoured. The decavanadate group has orthorhombic *mmm* symmetry, and is basically the same as that in the zinc analog of hummerite.—G.D.C.

Sweet, Walter C. *See* Bergström, Stig M. 7535

7637 **Swingle, George D.; Miller, Robert A.; Luther, Edward T.; Hardeman, William D.; Fullerton, Donald S.; Sykes, C. Ronald; Garman, R. Keith.** (compilers and editors). Geologic map of Tennessee—East-central sheet: Nashville, Tennessee Div. Geology, scale 1:250,000, 1966.

7640 **Swingle, George D.; Hardeman, William D.; Fullerton, Donald S.; Sykes, C. Ronald; Miller, Robert A.** Geologic map of Tennessee—East sheet: Nashville, Tennessee Div. Geology, scale 1:250,000, 1966.

Sykes, C. Ronald. *See* Swingle, George D. 7637

Sykes, C. Ronald. *See* Miller, Robert A. 7638

Sykes, C. Ronald. *See* Swingle, George D. 7640

Talbot, J. L. *See* Hobbs, B. E. 7660

Tanner, James T. *See* Ehmann, William D. 7588

7314 **Taylor, Alfred R.** Geologic map of the Mannsville quadrangle, south-central Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ 562, scale 1:24,000, section, text, 1966.

In the Mannsville quadrangle clay shale of the Borden Formation is a potential source of raw material for bricks, tile, and lightweight aggregate. Gravel, mostly chert, is readily available in great quantity in streams for use as road metal. M.C.M.

7360 **Tennessee Division of Geology.** Status of detailed geologic mapping in Tennessee, July 1, 1966: Nashville, Tennessee Div. Geology, 1 sheet, 1966.

7416 **Termier, Genevieve; Termier, Henri; Pajaud, Daniel.** Découverte d'une thécidée dans le Permien du Texas: Acad. Sci. Comptes Rendus, ser. D, v. 263, no. 4, p. 332–335, illus., 1966.

Until now, the oldest known thecideacean were from the Rhetian of Austria. A block from the Word Formation (Permian) of the Glass Mountains of Texas has yielded several brachial valves of a new form described here under the name *Cooperina inexpectata* n. gen., n. sp.—D.B.V.

Termier, Henri. *See* Termier, Genevieve. 7416

7396 **Terry, Richard D.** (compiler and editor). Ocean engineering, V. 4—Pt. 1, Mineral exploitation [revised]: North Hollywood, Calif., Western Periodicals Co. (for Natl. Security Indus. Assoc.), 196 p., illus., tables, 1966.

Costly programs to speed up mineral production from the hydrosphere do not appear to be justified at present. The extremely low concentration of elements in sea water is a major deterrent to production of minerals now obtained from rocks. Technology is well developed for exploitation of nearshore and beach deposits such as ilmenite, rutile, zircon, oil, gas, and sulfur, as need arises. Exploration on the continental shelves should provide more precise information concerning size of deposits, their location and environment. The petroleum industry is prepared to

exploit waters at depths of 600–1,000 feet and beyond the limits of the continental shelf. Major problems inhibiting exploitation of manganese nodules and vast red clays and oozes of the deep sea floor concern techniques of recovery and refining and the deep ocean environment.—G.D.C.

Theokritoff, G. *See* Berry, W. B. N. 7373

Thomas, J. D. *See* Bain, George L. 7491

7537 **Thomas, L. A.** Geology of the San Manuel ore body, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 133–142, illus., table, 1966.

The San Manuel mine in Arizona ranks among the major copper mines in the western hemisphere. It is a disseminated deposit, with mineralization localized in quartz monzonite, monzonite porphyry, and diabase. Intrusion of the porphyry was followed by diabase intrusion, and fracturing by compression. Invasion by hydrothermal solutions of varying composition produced intense alteration. The primary ore minerals were deposited when potash content was high. Ore localization is related to rock permeability. The deposit was intruded by minor dikes, and has undergone at least three epochs of oxidation and enrichment.—E.S.L.

7704 **Thompson, Mary E.** Magnesium in sea water—An electrode measurement: Science, v. 153, no. 3738, p. 866–867, table, 1966.

Magnesium ion in standard I.A.P.O. sea water was measured with a magnesium-sensitive electrode. The results, presented either as magnesium-ion activity (0.017) or as the amount of ionized magnesium (0.048M or about 90 percent of the total magnesium), agree well with the data from the chemical model for sea water proposed by Garrels and Thompson [1962].—Author's abstract

7273 **Thomson, Keith Stewart.** On the relationships of certain Carboniferous Dipnoi, with descriptions of four new forms: Royal Soc. Edinburgh Proc. 1964–66, sec. B, v. 69, pts. 3–4, p. 221–245, illus., 1966.

The ctenodontid lungfish genus *Prosagenodus* Romer and Smith 1934 is reexamined and its type species *P. interruptus* is reassigned to *Ctenodus* and redescribed as *C. interruptus* Barkas 1869. *Ctenodus romeri* n. sp. and *Straitonia waterstoni* n. gen. n. sp. are described; all three species are from the Lower Carboniferous of Scotland. The United States species *Prosagenodus castrensis* Romer and Smith 1934, from the type Chester (Upper Mississippian) of Illinois, becomes type species of the new genus *Tranodis*, and is redescribed from a newly found partial skull and other bones from the Upper Mississippian Greenbrier Series near Morgantown, W. Va. Phylogenies of *Ctenodus and Sagenodus* are discussed in the light of these discoveries.—V.M.J.

7531 **Titley, Spencer R.; Hicks, Carol L.** (editors). Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, 287 p., illus., tables, geol. maps, 1966.

The first part of this book, dedicated to Dr. Eldred Dewey Wilson, contains eight general papers, related to areal geology, host rocks, alteration, mineralization, structure, and exploration. Fifteen papers, describing individual deposits, mines, and districts, comprise the second part. All papers are cited separately.—E.S.L.

Tolbert, W. H. *See* Salsman, G. G. 7301

7367 **Toler, L. G.** Fluoride content of water from the Floridan aquifer in northwestern Florida: Florida Board Conserv. Div. Geology Map Ser., no. 23, scale about 1 in. to 16 mi., text, 1966.

The Floridan aquifer underlies all of Florida and consists of a thick section of limestone which locally may contain lenses of sand and clay; rocks forming the aquifer are at or near the surface in most of the eastern part of the mapped area, and the top of the aquifer is from 260 to 1,200 feet below the surface in the west-central part. Fluoride concentration patterns shown on the map are generalized;

some of the data suggest that fluoride content of the water may increase with depth of penetration into the aquifer. Possible sources of fluoride are naturally occurring minerals such as phosphate minerals, topaz, tourmaline, mica, glauconite, and fluorite. No analytical data are available to determine whether any of these minerals is the principal source of the fluoride.—M.C.M.

Toulmin, Martha S. *See* Robie, Richard A. 7327

7602 **Traganza, Eugene Dewees.** Dynamics of the carbon dioxide system on the Great Bahama Bank [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, 61B–62B, 1966.

7430 **Tremblay, L. P.** Contwoyto Lake map-area, District of Mackenzie: Canada Geol. Survey Paper 65–21, 17 p., geol. map, 1966.

The Contwoyto Lake map-area is underlain almost entirely by Precambrian metamorphosed sedimentary rocks, the stratigraphy and petrology of which are outlined. Gold has been reported from many showings, the Canadian Nickel prospect on Contwoyto Lake being the most important to date. Gold is found in the garnet–cummingtonite–quartz–sulfide gneiss, closely associated with pyrite or pyrrhotite and arsenopyrite.—E.S.L.

7250 **Trollope, F. H.** Wabamun Pool, Crossfield gas field [abs.]: Oilweek, v. 17, no. 30, p. 34, 1966.

7592 **Tuke, M. F.; Dineley, D. L.; Rust, B. R.** The basal sedimentary rocks in Somerset Island, N.W.T.: Canadian Jour. Earth Sci., v. 3, no. 5, p. 697–711, illus., 1966.

In northwestern Somerset Island, sandstones of the Aston Formation rest unconformably on basement rocks, and are conformably overlain by Hunting Formation dolostones, of which four members are described. Stromatolites form conspicuous parts of some sections of both formations, and they have been interpreted previously as Proterozoic. Ordovician strata conformably overlie the Hunting, and since a similar succession with Middle Cambrian trilobites at the base occurs on Boothia Peninsula, it is suggested that the Aston and Hunting Formations comprise a Paleozoic succession continuous with the fossiliferous Ordovician rocks.—E.S.L.

Tunell, G. *See* Arntson, R. H. 7574

Tupper, W. M. *See* Stockwell, C. H. 7378

Tupper, W. M. *See* Boyle, R. W. 7589

7305 **Upshaw, Charles F.; Creath, Wilgus B.; Brooks, Frank L.** Sediments and microfauna off the coasts of Mississippi and adjacent states: Mississippi Geol. Econ. and Topog. Survey Bull. 106, 127 p., illus., tables, 1966.

This study of modern sediments from the Gulf of Mexico is intended to provide a model of a continental shelf area against which ancient sediment sequences can be compared. Sampling and laboratory procedures are described. Both size distribution and composition of the sediments are discussed, tabulated, and shown on graphs and maps. Foraminifera comprise most of the microfauna, along with a few ostracodes. Assemblage diagrams, and maps showing distribution are included. Several charts show bathymetry and faunal composition, and tables show physical, chemical, and microfaunal data, clay mineral analyses, and isotopic composition of organic carbon.—E.S.L.

Urena, Rafael de. *See* Emmons, Walter F. 7561

7595 **U.S. Bureau of Mines.** (Division of Mineral Resources). Mineral resources and mineral industry of the Meramec River basin, Missouri, App. J *in* Meramec River, Missouri—Comprehensive basin study, V. 6: St. Louis, Mo., U.S. Army Corps Engineers, 109 p., illus., tables, 1966.

About one-third of the total value of Missouri's mineral production originates in or near the Meramec basin; major commodities are lead, limestone, sand and gravel, and barite. Lead occurs in the Bonneterre dolomite; limestone and dolomite reserves are widespread and unlimited; sand and gravel are produced from fluvial deposits, and ultra-pure silica sand from St. Peter Sandstone; barite is distributed erratically in residual clays on Potosi and Eminence strata; refractory clays from sinkholes in the Graydon are the chief mineral industry in the central and western basin; sedimentary and magnetite-hematite ores have produced considerable iron; and monumental-stone granite reserves are unlimited. Reserves of barite and refractory clays are unknown but proposed reservoirs will probably inundate those areas. Mineral maps of each county accompany the paper.—E.S.L.

7321 **U.S. Geological Survey.** Aeromagnetic map of the San Francisco Mountains and vicinity, southwestern Utah: U.S. Geol. Survey Geophys. Inv. Map GP-598, scale 1:62,500, 1966.

7594 **Utsu, Tokuji.** Variations in spectra of P waves recorded at Canadian Arctic seismograph stations: Canadian Jour. Earth Sci., v. 3, no. 5, p. 597-621, illus., tables, 1966.

The variations in seismograms of P-waves of Alaskan earthquakes recorded at the four stations can be attributed mainly to crustal structure beneath the stations, after proper corrections are made. However, quantitative agreement with the theory, assuming horizontal layering and perfect elasticity, is not found. Use of the vertical to radial horizontal spectral amplitude ratios suggests that the crust thins toward the Arctic Ocean. Best estimates of thickness are 45 km at Coppermine, 33 km at Resolute, 23 km at Alert, and 18 km at Mould Bay.—E.S.L.

7419 **VanCampen, Darwin.** Red Mountain—Another reminder of the days when fire possessed the earth: Arizona Highways, v. 42, no. 5, p. 32-39, illus., 1966.

Red Mountain, in the San Francisco Volcanic Field of Arizona, is an extinct volcanic cone composed largely of tuff. One side is protected by lava flows, but the rest has been dissected. Erosional features in the heart of the cone are described and illustrated with photographs.—E.S.L.

7662 **Vance, J. A.** Patchy zoning in plagioclase—A reply [to discussion by A. G. Fraser, 1966]: Jour. Geology, v. 74, no. 4, p. 518-521, 1966.

Exsolution, suggested by Fraser (ibid., p. 515), is questioned in general as an initial process in formation of patchy zoning in plagioclase. It cannot be accepted in particular for the occurrences in the Cascade Mountains of Washington (Vance, ibid., v. 73, p. 636, 1965) because of inconsistencies in the compositional relations between hosts and patches.—R.E.W.

7270 **Vanderford, H. B.; Shaffer, M. E.** Comparison of fragipan and bisequal profiles of the Gulf Coastal Plain with soils of Southern Loess Belt: Soil Sci. Soc. America Proc., v. 30, no. 4, p. 494-498, illus., table, 1966.

This study compared morphological, physical, and chemical properties of some silty soils that developed in the Coastal Plain with features of similar soils that developed in the Southern Loess Belt. The results indicated that the fragipan soils of the Coastal Plain were similar in morphology to certain fragipan and bisequal profiles of the Loess Belt. The genesis of the bisequal profiles of the Coastal Plain appears to be similar to the genesis of soils in the Loess Belt under the same drainage conditions.—Authors' abstract

VanDerGiessen, N. *See* Neill, Charles R. 7556

7443 **VanOlphen, H.** Maya Blue—A clay-organic pigment: Science, v. 154, no. 3749, p. 645-646, 1966.

It is suggested that Maya Blue, a remarkably stable pigment used by the Mayas in Yucatan, is a complex of natural indigo adsorbed on the external surfaces of attapulgite particles. The complex as such is not stable to acids; the stability is

achieved by heating to 75°–150°C for several days. An analogous stable pigment can be prepared from sepiolite and indigo, but no stable pigments could be made from clays with plate-like structures or from zeolites.—D.B.V.

VanSant, Jan F. *See* Lokke, Donald H. 7578

7683 **VanValen, Leigh.** Deltatheridia, a new order of mammals: Am. Mus. Nat. History Bull., v. 132, art. 1, p. 1–126, illus., tables, 1966.

Reconsideration of Cretaceous and early Tertiary phylogeny of early placental mammals, especially creodonts, has resulted in removal of all creodonts except the Miacidae from the Carnivora. Arctocyonidae and their descendants, the Mesonychidae, are placed in Condylarthra, and a new order, Deltatheridia, is created for Oxyaenoidea, Palaeoryctidae, Didymoconidae, and *Micropternodus*. Morphology, systematics, and evolution of the palaeoryctid subfamily, Didelphodontinae, are considered in detail, and observations are made on other mammals, mainly deltatheridian. Greatest emphasis is placed on evolution of dental structure and occlusion. A detailed terminology is proposed for structures of primitive therian teeth; teeth of possible Paleocene oxyaenoid ancestors are described. Four new genera—two palaeoryctid, one didymoconid, one aphelescine insectivore—and three new species are described.—E.S.L.

Vassamillet, L. F. *See* Massalski, T. B. 7584

7542 **Velasco, J. Ruben.** Geology of the Cananea district, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 245–249, illus., 1966.

The Cananea district, in the State of Sonora, is the most important area of copper mineralization in Mexico. With its intensive alteration and widespread mineralization, its complex rock pattern, and its unusual and characteristic mineralized breccia structures, the district presents many interesting geological problems. Two important points are: the close relation between the quartz porphyry and breccia pipes in the search for deeper primary ores, and the intimate connection of late, steep dipping, wide shear and fracture zones in deposition of better grade secondary ore. The possibility of additional discoveries depends on a sound understanding of these features so that field observations may be interpreted correctly.—E.S.L.

7495 **Venuto, Louis J.** The creation of a college—The story of the growth of the College of Mineral Industries at the Pennsylvania State University: Privately printed, 140 p., illus., portrait, 1966.

This book gives a short biographical sketch of the inspiring mining engineer, Dean Edward Steidle, who built up the College of Mineral Industries, a short history of the school, its functions, the external structure and internal organization, and Dean Steidle's conceptions of the executive process.—G.D.C.

7622 **Vernon, James Wesley.** Shelf sediment transport system [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 1, p. 214B, 1966.

Villars, R. G. *See* Salsman, G. G. 7301

7716 **Wahlstrom, Ernest E.** Geochemistry and petrology of the Morrison Formation, Dillon, Colorado: Geol. Soc. America Bull., v. 77, no. 7, p. 727–739, illus., 1966.

Chemical analyses and petrographic characteristics indicate that the volcanic ash in the upper noncalcareous part of the Morrison Formation at Dillon, Colo., probably was derived from a distant rhyolitic source and underwent extensive alteration to clay minerals and cryptocrystalline quartz after deposition. The lower, calcareous part does not contain any materials that are demonstrably of volcanic origin. Deposition of the Morrison rocks as discontinuous lenses in a fluvial and lacustrine environment and erratic post depositional alteration prevent use of clay mineralogy as a dependable basis for regional or local correlation of units within the formation.—H.C.W.

7227 **Waller, Roger M.** Groundwater hydrology, Chap. 7 *in* Environment of the Cape Thompson region, Alaska: U.S. Atomic Energy Comm. Rept. PNE-481, p. 115-124, illus., 1966.

Groundwater in areas surrounding the Chariot site, Ogotoruk Creek area, Alaska, occurs in two distinct environments, shallow aquifers associated with stream floodplains, and deep aquifers associated with major fault systems in limestone and dolomitic rocks. The influence of climate and permafrost, recharge and depletion mechanisms, and water motion are considered for both. Specific aquifers in the area are characterized.—Author's abstract

7658 **Warren, Harry V.; Delavault, Robert E.; Barakso, John.** Some observations on the geochemistry of mercury as applied to prospecting: Econ. Geology, v. 61, no. 6, p. 1010-1028, illus., tables, 1966.

Normal soil samples from British Columbia contain less than 0.05 ppm Hg. Soils from the vicinity of gold, molybdenum, and base metal deposits contain 0.05 to 0.25 ppm, and locally 2 ppm. Soils around mercury deposits contain 1 to 10 ppm or more. Ash of first and second year growth of certain trees and plants may "be considered normal if it carries between 1 and 10 ppm of mercury in mineralized areas, possibly anomalous if it runs from 10 to 20 ppm, and probably anomalous where it contains 20 ppm or more of mercury." The ratio of mercury in plants to that in associated soils decreases with increasing total Hg.—W.S.W.

7272 **Washington, R. A.; Holman, R. H. C.** A rapid and sensitive method for determining gold in rocks and other geological materials: Canada Geol. Survey Paper 65-7, 18 p., illus., tables, 1966.

Preliminary tests have indicated the feasibility of using the classical method of fire assay to concentrate gold in a silver bead from silicate rocks for subsequent neutron activation analysis using instrumental techniques. Radiochemical separation of gold following activation is not required. The detection limit, using silver as a collector, is about 0.01 ppm Au for a sample weight of one assay ton (29.2 g). The precision for homogeneous samples, is likely to be about 1 to 2 percent at 1 ppm, falling to around 50 percent near the detection limit. The proposed method is essentially simple and it is estimated that the probable productivity would be about 25 to 30 determinations per man day. Improved techniques are suggested that should lower the detection limit by a factor of about ten.—Authors' abstract

7391 **Webb, Robert W.** Memorial to William John Miller (1880-1965): Geol. Soc. America Bull., v. 77, no. 8, p. P155-P159, portrait, 1966.

7359 **Webber, G. R.** Relative depth of origin of alkali and tholeiitic rocks: Earth and Planetary Sci. Letters, v. 1, no. 4, p. 183-184, 1966.

The theories of upward concentration of certain elements in the mantle suggest to Webber that the alkali basalts may have originated at shallower depths than tholeiitic rocks.—W.R.A.

7292 **Weber, Jon N.; Raup, David M.** Fractionation of the stable isotopes of carbon and oxygen in marine calcareous organisms. The Echinoidea—Pt. 2, Environmental and genetic factors: Geochim. et Cosmochim. Acta, v. 30, no. 7, p. 705-736, illus., tables, 1966.

The carbon and oxygen isotopic composition of the calcite skeleton of recent sea urchins and sand dollars has been determined for representatives of all major taxonomic groups, comprising a worldwide sampling of the class Echinoidea and including polar to tropical and littoral to abyssal dwellers. Large variations in δC^{13} and δO^{18} for the tests and parts of the echinoid lantern are apparent. The degree of fractionation is largely genetically controlled, although the effect of temperature is detectable, especially in the case of O^{18}/O^{16}. Carbon and oxygen isotope ratios are correlated with crystallographic data, and the application of this information to phylogenetic problems is discussed with two examples.—D.B.V.

7295 **Weber, Jon N.; Raup, David M.** Fractionation of the stable isotopes of carbon and oxygen in marine calcareous organisms. The Echinoidea—Pt. 1, Variation of C^{13} and O^{18} content within individuals: Geochim. et Cosmochim. Acta, v. 30, no. 7, p. 681–703, illus., tables, 1966.

Systematic study of distribution of C–13 and O–18 in the calcite skeletons of recent sea urchins and sand dollars shows that these animals fractionate both C and O isotopes to a considerable extent. Within a single skeleton δC–13 may vary systematically by as much as 13 permil. In general, the coronal plates are greatly enriched in C–12 with respect to the spines which are similar in isotopic composition to most other marine invertebrates; the different parts of the lantern differ in δC–13 and δO–18 values by several permil. Variation in degree of isotopic fractionation during growth appears to be relatively small.—D.B.V.

7365 **Weisbord, Norman E.** Some Late Cenozoic cirripeds from Venezuela and Florida: Bulls. Am. Paleontology, v. 50, no. 225, p. 1–145, illus., table, 1965 [1966].

Nine species of barnacles from northern Venezuela, and four species of barnacles from northern Florida are described, compared, and illustrated. The Venezuelan barnacles occur in the Cabo Blanco group, and eight of them are Pliocene and one Pleistocene. The Floridan barnacles occur in the Choctawhatchee Formation at Jackson Bluff and are late Miocene in age. Discussed briefly are the "interlaminate figures" displayed in the walls of barnacles; the designation of "right" and "left" for the valves of the operculum; and a method of recovering opercular valves entombed in the shell. The citations in the Bibliography [80 pages] deal primarily with barnacles in the Order Thoracica.—Author's abstract

7481 **Weld, Betsy A.; Griffin, Margaret S.; Brett, George W.** Reports and maps of the Geological Survey released only in the open files, 1965: U.S. Geol. Survey Circ. 518, 16 p., 1966.

Wessels, Vincent E. *See* Story, James A. 7666

7593 **Westermann, G. E. G.** The holotype (plastotype) of *?Titanites occidentalis* Frebold from the Kootenay sandstone (Upper Jurassic) of southern British Columbia: Canadian Jour. Earth Sci., v. 3, no. 5, p. 623–625, illus., 1966.

The supplementary description of the giant *?T. occidentalis* is based on the "holo–plasto–type", including the hitherto unknown densely ribbed penultimate whorl. After discussion of affinities and geological age, Frebold's original suggestions are tentatively supported.—Author's abstract

7278 **Wetherill, G. W.** K–Ar dating of Precambrian rocks, *in* Potassium argon dating: New York, Springer Verlag, p. 107–117, illus., tables, 1966.

Much of the early K–Ar dating was on Precambrian rocks because the concentration of radiogenic argon was so much greater than in younger rocks that analytical difficulties were minimized. A serious disadvantage to dating these rocks is the loss of radiogenic argon by diffusion or later orogenies. Time gaps are often a feature of deep seated plutons, due to slow cooling. However, radiogenic argon is retained very well under sufficiently tranquil geologic conditions. The complexities introduced by the multiple metamorphic history of most Precambrian areas are too great to be unraveled by K–Ar measurements alone, and a combined K–Ar, Rb–Sr, and U–Pb, and geologic approach is needed.—E.S.L.

7345 **Wetherill, George W.** Radioactive decay constants and energies, Sec. 23 *in* Handbook of physical constants (revised edition): Geol. Soc. America Mem. 97, p. 513–519, tables, 1966.

Selected values of the natural radioactive decay constants, measurements of specific gamma activity of potassium using scintillation spectrometers, measurements of Rb^{87} half life and Re^{187} half life, decay constants of C–14 and H–3, and decay energies of U, Th, and K are tabulated. The final table gives several versions of the geologic time scale. Since rocks dated radioactively never fall exactly on the boundary

between two geologic periods, some interpolation is necessary. No great accuracy can be claimed for such a process.—G.D.C.

7283 **White, John A.** A new *Peromyscus* from the late Pleistocene of Anacapa Island, California, with notes on variation in *Peromyscus Nesodytes* Wilson: Los Angeles County Mus. Contr. Sci., no. 96, 8 p., illus., table, 1966.

A new fossil rodent, *Peromyscus anyapahensis*, is described from one of the California offshore Channel Islands. The new form is compared to closely related forms.—Author's abstract

7684 **White, Richard W.** Ultramafic inclusions in basaltic rocks from Hawaii: Contr. Mineralogy and Petrology, v. 12, no. 3, p. 245–314, illus., tables, 1966.

Sixty-eight inclusions and 13 basaltic rocks from 46 localities in the Hawaiian Islands are described, with partial chemical analyses. Standard petrographic and electron microscope techniques were used for the study. The inclusions are in three catagories which correlate with three groups of host rocks. Lherzolite inclusions, relatively poor in Fe and with component minerals limited in composition, occur preferentially in extremely undersaturated hosts. Other varieties of inclusions are rich in Fe, the component minerals having wider ranges of composition; together with gabbro, they occur in moderately undersaturated hosts. The sparse inclusions in nearly saturated basalt are petrographically distinct from the other two categories. A genetic relation between inclusions and host rocks is suggested; for the differing inclusions, more than one origin is probable.—G.D.C.

7497 **White, William B.; Schmidt, Victor A.** Hydrology of a karst area in east-central West Virginia: Water Resources Research, v. 2, no. 3, p. 549–560, illus., 1966.

Movement of ground water through a maturely karsted limestone aquifer in Pocahontas County, was studied by dye tracing and extensive underground mapping. The aquifer consists of 400 feet of flat lying Mississippian Greenbrier Limestone. The drainage basin of Hills Creek is enclosed by clastic rocks, and discharge is by subterranean flow. The Swago Creek underground drainage lines cross major surface divides. Underground divides have been mapped and lie under either valleys or ridges. The rugged surface topography is not reflected in the flat karst water table, and free-surface flow occurs 1,000 feet below the land surface. Insoluble beds perch tributary underground streams several hundred feet above base level. Hydraulic gradients point to the Greenbrier River as the major base-leveling stream.—E.S.L.

7526 **Whittington, H. B.** Phylogeny and distribution of Ordovician trilobites: Jour. Paleontology, v. 40, no. 3, p. 696–737, illus., 1966.

Shortly before or during Tremadoc time the majority of pre-existing trilobite families died and were replaced by new, short-lived groups and early members of dominant Ordovician families. Endemic forms define six faunas separated into northern and southern provinces, without regard for enclosing lithic type. Constancy of distribution from Arenig to Llandeilo implies physical stability. Reduced endemism in the Caradoc and Ashgill probably reflects reduced barriers and broad oceanic circulation.—R.E.G.

7417 **Wilcoxson, Kent H.** Chains of fire—The story of volcanoes: Philadelphia and New York, Chilton Books, 235 p., illus., tables, 1966.

The 20 chapters describe famous volcanoes such as Pelée, Vulcan, Mt. Katmai, Vesuvius, Stromboli, Etna, Krakatoa (and others in the East Indies), Taal, and Kamchatka; effusions and explosions in the American West; Mexican volcano babies; Central America, the Andes, and Middle Atlantic Ridge; fissures and floods in Iceland; roots of volcanoes; andesite line in New Zealand; volcanoes made in Japan; and volcanoes—past, present, and future. A glossary, bibliography, and index are appended.—M.C.M.

7420 **Wilde, Pat.** Quantitative measurements of deep-sea channels on the Cocos Ridge, east central Pacific: Deep-Sea Research, v. 13, no. 4, p. 635–640, illus., table, 1966.

Precision depth records taken during Criss–Cross Expedition 1963 show deep-sea channels at depths of 1,400 to 2,800 m on the Cocos submarine ridge. The channels are near the thalwegs of broad submarine valleys, which trend normal to the axis of the ridge. A closed depression at the landward end of the ridge and a central saddle prevent continental material from being transported into the region of the channels. The currents that produce the channels may be local turbidity currents, laden with ash. Hydraulic functions are calculated, and show that in a downslope direction the channel depth is maintained at the expense of the width, which suggests a channel flow that has its sediment load concentrated near the base, but deposits chiefly on its flanks by overbank spillage.—*from* Author's abstract

7399 **Wilimovsky, Norman J.; Wolfe, John N.** (editors). Environment of the Cape Thompson region, Alaska: U.S. Atomic Energy Comm. Rept. PNE-481, 1250 p., illus., tables, geol. maps, 1966.

The mouth of Ogotoruk Creek, near Cape Thompson, was selected as a possible site for Project Chariot, an experimental harbor excavation by nuclear explosion. Chapters, most of which are cited separately, describe the physical characteristics of the land and of the Chukchi Sea, Arctic beach sedimentation, and an aeroradioactivity survey. The land biotic systems, bioenvironment, and the people are discussed also. Separate maps show geographic names, areal and engineering geology, soils, vegetation, and radioactivity. Russian translations of the abstracts are included.—E.S.L.

7246 **Wilkins, A.** Mississippian paleotopography in the Medicine River area [abs.]: Oilweek, v. 17, no. 30, p. 42, 1966.

7505 **Williams, Dennis E.** Viscous model study of groundwater flow in a wedge-shaped aquifer: Water Resources Research, v. 2, no. 3, p. 479–486, illus., table, 1966.

Ground water flow in sands of nonuniform thicknesses is two-dimensional in nature. Assuming that the slopes of the confining beds are less than 0.2, the head distribution in two-dimensional flow problems can be approximated by the distribution that would occur if the flow were horizontal only. This yields solutions that are simpler to use. The experimental results establish the validity of these solutions.—E.S.L.

Williams, Janet L. *See* Cridland, Arthur A. 7291

7383 **Willman, H. B.; Glass, H. D.; Frye, John C.** Mineralogy of glacial tills and their weathering profiles in Illinois—Pt. 2, Weathering profiles: Illinois Geol. Survey Circ. 400, 76 p., illus., tables, 1966.

Grain-size and mineral analyses were made of 26 samples from 6 localities, and X-ray diffraction analyses were made of 140 samples from 12 localities. The terminology used for buried weathered profiles, and the stratigraphic terms used are explained and tabulated. The field relations of each locality and the genetic implications are discussed in alphabetical order. The greater part of the report is devoted to changes affected by weathering on grain size, clay minerals, common rocks and minerals, and heavy minerals. The major loss of volume is by carbonate solution, and the effect on grain size is greater in the pebble fractions. Alteration of clay minerals affects a change in appearance between zones. It is suggested that most of the material called gumbotil is a sediment, accretion gley. Described stratigraphic sections for the 12 localities are presented at the end of the report.—E.S.L.

Wilson, Charles W., Jr. *See* Barnes, Robert H. 7307

7310 **Wilson, Charles W., Jr.; Miller, Robert A.** Geologic map of the Watertown quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 318-SW, scale 1:24,000, separate text, 1966.

The accompanying text, "Mineral resources summary of the Watertown quadrangle, Tennessee," by D. S. Fullerton is cited separately.—M.C.M.

7635 **Wilson, Charles W., Jr.; McCary, Charles E. L.; Barnes, Robert H.** Geologic map of the Milky Way quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 58 SE, scale 1:24,000, separate text, 1966.

The accompanying text, "Mineral resources summary of the Milky Way quadrangle, Tennessee" by R. E. Hershey and C. E. L. McCary is cited separately.—M.C.M.

7636 **Wilson, Charles W., Jr.** Geologic map of the Hermitage quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 311 NE, scale 1:24,000, separate text, 1966.

The Carters, Bigby Cannon, and Ridley Limestones in the Hermitage quadrangle contain the most desirable stone for general purposes. There are limited reserves of gravel near inactive pits, but possibilities exist in the flood plain alluvium along a lake and several streams. Phosphate is a potential resource.—M.C.M.

7586 **Wilson, J. Tuzo.** Are the structures of the Caribbean and Scotia arc regions analogous to ice rafting?: Earth and Planetary Sci. Letters, v. 1, no. 5, p. 335–338, illus., 1966.

Two colliding ice sheets may overlap and interfinger, and the boundaries between fingers fit the definition of transform faults. It is proposed that the Antilles arc forms the tip of a great finger-raft of lithosphere advancing eastward. If this analogy is correct it explains why the east–west faults bounding the Caribbean do not extend into the Atlantic or Pacific. Since the overridden finger would probably be re-absorbed by the mantle, this may also explain the anomalous thickness and composition of the crust in the eastern Caribbean.—E.S.L.

Winchester, John W. *See* Schilling, Jean-Guy, 7680

7460 **Witherspoon, P. A.; Saraf, D. N.** Diffusion of methane, ethane, propane, and N butane in water [abs.], *in* Advances in organic geochemistry, 1964: Oxford, England, Pergamon Press (Internat. Ser. Mons. Earth Sci., V. 24), p. 259, 1966.

Wolfe, John A. *See* Story, James A. 7666

Wolfe, John N. *See* Wilimovsky, Norman J. 7399

7304 **Wood, H. O.; Heck, N. H.; Eppley, R. A.** Earthquake history of the United States—Pt. 2, Stronger earthquakes of California and western Nevada: U.S. Coast and Geodetic Survey [Pub.] 41-1, revised ed. (through 1963), 48 p., illus., tables, 1966.

In this revised edition, corrections and additions have been made to the text of the 1960 edition. Earthquakes in California and Nevada represent about 90 percent of the seismic activity of the continental United States, excluding Alaska. The lower limit of earthquakes included generally is VI on the Mercalli scale. Earthquakes are tabulated in chronological order, and descriptions given of 10 major ones. Concise descriptions are given also for intermediate and minor earthquakes.—E.S.L.

7489 **Wood, Richard G.** Stephen Harriman Long, 1784–1864, army engineer, explorer, inventor: Glendale, Calif., Arthur H. Clark Co., 292 p., illus., 1966.

7439 **Woodcock, Alfred H.; Rubin, Meyer; Duce, R. A.** Deep layer of sediments in alpine lake in the tropical mid-Pacific: Science, v. 154, no. 3749, p. 647–648, illus., 1966.

More than 7.5 m of sediments, recently found on the bottom of the lake in Waiau Cone on extinct Mauna Kea Volcano on the island of Hawaii, contain a record of ash falls and other airborne and waterborne materials for a period estimated to extend back into the Pleistocene. Organic matter found at depths of 1 and 2 m was dated by the radiocarbon method as 2,270±500 and 7,160±500 yr, respectively. The first coarse ash layer, 4,500 yr old, is 1.5 m below the surface. Extrapolation of the age-depth curve suggests 30,000 yr as the maximum age of the deepest sediments.—D.B.V.

7448 **Yagi, Kenzo; Matsumoto, Hatao.** Note on leucite-bearing rocks from Leucite Hills, Wyoming, U.S.A.: Hokkaido Univ. Fac. Sci. Jour., ser. 4, v. 13, no. 3, 301–311, illus., tables, 1966.

As a result of petrographic examination, chemical analyses, and thermal experiments on samples of leucite-bearing rocks from the Leucite Hills of Wyoming, it is concluded that the rocks were derived directly from partial melting of the upper mantle, probably mica peridotite, with assimilation of granitic or other salic rocks. Detailed studies were made of wyomingite and orendite and their xenoliths. Data are tabulated.—V.S.N.

7475 **Yamaguti, Seiti.** On the changes in the heights of mean sea-levels at Portland, Maine, and at Baltimore, Md., U.S.A.: Toyko Univ. Earthquake Research Inst. Bull., v. 44, pt. 1, p. 141–152, illus., tables, 1966.

Mean sea-levels were calculated for each month in the period 1912–58 at Portland, Maine, and in the period 1903–58 at Baltimore, Md., and were compared with those at San Francisco and Los Angeles (Yamaguti, 1962) and at Aburatsubo in Japan; monthly deviations are tabulated. No evidence of increase in total mass of water in the Pacific and Atlantic Oceans could be found, but rather a difference of ground movement or inclination of ground between the two oceans. In general, the eastern curves show a slightly decreasing tendency over the years. From 1924 to 1958 on the west coast there was a tendency for mean sea-levels to increase about 4 or 5 mm/year, with a similar amount of continuous subsidence of ground; this agrees with findings reported by D. Tocher (1964) that crustal deformation in coastal California is mostly horizontal, with slight subsidence.—G.D.C.

7672 **Yasso, Warren E.** Heavy mineral concentration and sastrugi-like deflation furrows in a beach salcrete at Rockaway Point, New York: Jour. Sed. Petrology, v. 36, no. 3, p. 836–838, illus., 1966.

Rapid wind-drying of marine beach sands at Rockaway Point forms a crusted surface termed a salcrete. Continued wind action forms sastrugi-like deflation furrows in the berm that have steep borders supported by the salcrete. Miniature dunes formed on the salcrete have bands of dark heavy minerals around their leeward bases.—R.A.C.

7527 **Yochelson, Ellis L.** An operculum associated with the Ordovician gastropod *Helicotoma*: Jour. Paleontology, v. 40, no. 3, p. 748–749, illus., 1966.

An operculum associated with *Helicotoma* is described from the Middle Ordovician Tyrone Limestone of Kentucky. If assignment to this genus is correct, it suggests that the Euomphalacea and the Oriostomatacea are distinct lineages.—R.E.G.

7261 **Young, F. G.** The geology of the Edson Elkton gas reservoir [abs.]: Oilweek, v. 17, no. 30, p. 34, 1966.

Zähringer, J. *See* Schaeffer, O. A. 7243

Zähringer, J. *See* Krankowsky, D. 7281

7643 **Zangerl, Rainer.** A new shark of the family Edestidae, *Ornithoprion hertwigi*, from the Pennsylvanian Mecca and Logan Quarry shales of Indiana: Fieldiana—Geology, v. 16, no. 1, p. 1–43, illus., 1966.

A new genus and species of very small, rare edestid shark with greatly elongated mandibular rostrum is described from nine specimens including three articulated skulls in lateral view, from upper Westphalian shales in Parke County, Ind. The specimens are preserved in essentially two dimensions; because of their fragility and the resistance of the shale, radiographic techniques and thin sections are the only feasible study methods. Stereoscopic radiograms were made to grossly exaggerate the vertical depth perception. Enlarged stereo positives and negatives were produced; drawings were made from these viewed through a standard stereoscope. Calcified cartilages, dentition teeth, and denticles were also studied in thin section.

Theories of origin of dermal armor are reviewed, and special functions of skull elements of *Ornithoprion* are discussed.—V.M.J.

Ziauddin, M. *See* Boyle, R. W. 7589

7425 **Zimmerman, Everett A.** Geology and ground-water resources of western and southern parts of Judith Basin, Montana: Montana Bur. Mines and Geology Bull. 50-A, 33 p., illus., tables, geol. maps, 1966.

Sedimentary strata ranging in age from Mississippian to Quaternary are exposed in the area, and their water-bearing characteristics are described. Recharge is mostly from precipitation and streams in the surrounding mountains and foothills. Ground water, the source of most domestic water, is generally hard, but of satisfactory quality. An isopach map of the Amsden Formation and a piezometric map of the Kootenai Formation in the western part of the area accompany the report.—E.S.L.

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